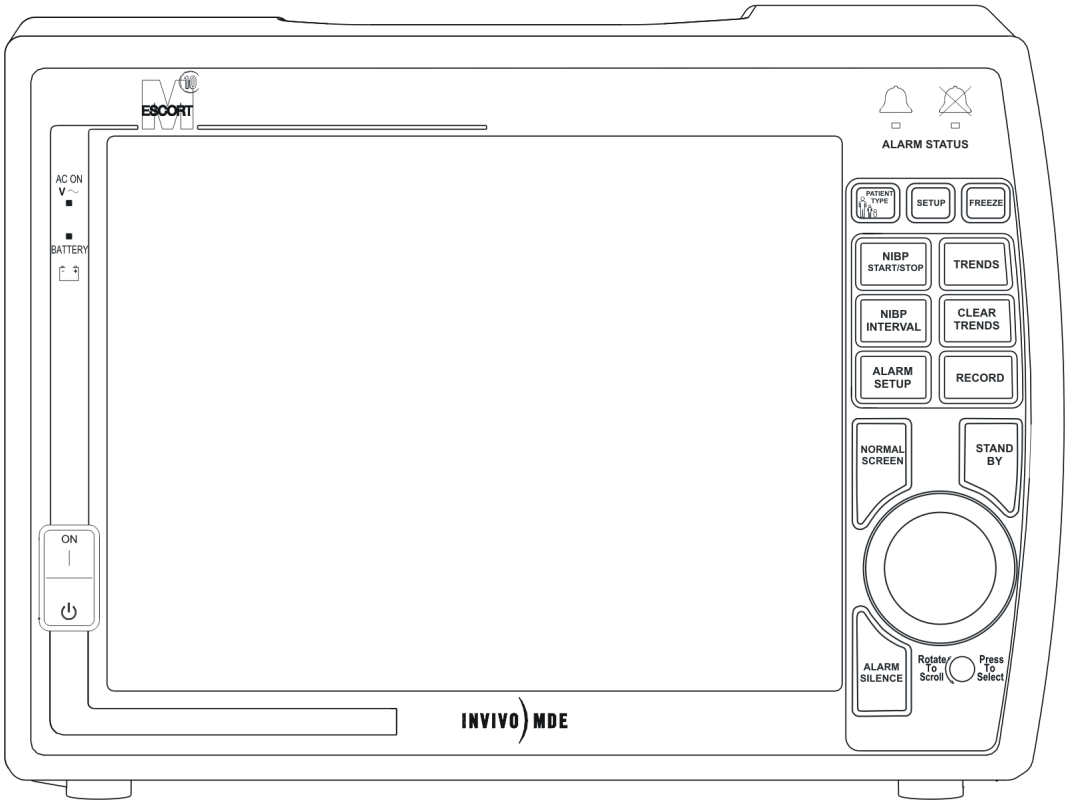
E9040-64

Escort M10
Vital Signs Monitor



Service Manual

InvivoMDE
An Intermagnetics Company

InvivoMDE

Escort M10
Vital Signs Monitor

Service Manual

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SECTION 1
INTRODUCTION

1.0 INTRODUCTION.

1.1 General Description. The **Escort M10 Vital Signs Monitor** is a patient monitor capable of keeping track of several parameters simultaneously, including dual vector ECG, Respiration, SPO2, Noninvasive Blood Pressure, one to three Invasive Blood Pressures, 2 Temperatures, ETCO2 and Cardiac Output.

The **Escort M10 Vital Signs Monitor** is factory equipped with a color display screen that is capable of displaying as many as five waveform traces simultaneously. This display accurately reproduces physiological waveform abnormalities, providing the detail needed to make clinical decisions.

The **Escort M10 Vital Signs Monitor** may be operated with AC, battery, or external DC power.

The **Escort M10** can monitor adult, pediatric, and neonatal patients. The appropriate monitoring mode for each patient, ADULT, PED, or NEO, is selectable. Changing from one mode to another automatically changes all appropriate algorithms, alarm limits, and any applicable parameter defaults.

The **Escort M10 Vital Signs Monitor** minimizes the number of function keys you see at any one time. Some keys, fixed function keys, are labeled on the front panel and always retain the same function. Other options are not labeled and vary in function according to the icon labels/menus displayed on the monitor's screen. For more information on the monitor keys and their functions, see Section 2, **"Controls & Indicators"**.

Factory defaults have been established and installed for all system and physiological monitoring issues (i.e., alarm settings, default ECG lead, etc.). These values may be easily reconfigured to meet your specific needs.

This service manual provides readily available documentation to troubleshoot, repair, and maintain the **Escort M10 Vital Signs Monitor**. It outlines functional block diagrams, board layouts, and schematic diagrams. Also included are performance check and preventive maintenance sections in Section 9 to keep your **Escort M10 Vital Signs Monitor(s)** working efficiently and reliably for many years to come.

PRECAUTIONS

GENERAL SERVICE PRECAUTIONS

Notes, Cautions and Warnings. The following is a description of the format and meaning of Notes, Cautions and Warnings that appear in the body of this manual:

a. Notes. Notes are text boxes which contain special operational information applicable to the step or procedure which they precede. The Note box contains no bordering lines. Notes are presented as shown below.

NOTE

This is a sample note.

b. Cautions. A Caution is a statement that alerts the user to the possibility of a problem with the device associated with its use or misuse. Cautions are bordered top and bottom with thick lines. Cautions are presented as shown below.

CAUTION

This is a sample caution.

c. Warnings. A Warning is a statement that alerts the user to the possibility of injury, death or other adverse reactions associated with the use or misuse of the device. The Warning box is bordered top, bottom, left and right with thick lines. Warnings are presented as shown below.

WARNING

This is a sample warning (for an electrical shock hazard).

NOTE

In addition to these precautions, cautions and warnings are located in paragraph 2.1.2 (Pages 2-6 and 2-7), paragraphs 3.0 and 3.1 (Page 3-1), paragraph 3.1.6 (Page 3-5), paragraphs 6.1.7 and 6.1.8 (Page 6-4), paragraph 7.1 (Page 7-1), paragraph 8.0 (Page 8-1), paragraph 8.3.8 (Page 8-3), paragraph 9.3 (Page 9-1), paragraph 9.11.10 (Page 9-11), paragraphs 10.0 and 10.2 (Page 10-1), paragraph 11.1 (Page 11-1), paragraph 11.3 (Page 11-4), and paragraph 11.4 (Page 11-9).

Obtain a thorough understanding of each of the following precautions before attempting to perform any assembly/disassembly or service procedure. Damage to the instrument or injury to yourself may result if these precautions, as well as common sense, are <u>not</u> applied.

Service to this product should be performed at the recommended intervals only by trained, qualified service personnel familiar with the operation and service documentation for this monitor.

Shock Hazard exists when this monitor is operated without the chassis cover. Use caution when working on units with power applied.

Always disconnect monitor from AC Main Power before performing service on internal assemblies.

When operating the monitor from an AC power source, the wall receptacle must be a three-wire, grounded hospital grade AC power plug and cord, or an equivalent hospital grade plug and cord. If in doubt about the integrity of the grounding of the main supply connection, the unit should be operated solely on battery power.

Precautions

GENERAL SERVICE PRECAUTIONS

To avoid summation of leakage currents, do not plug the unit into a multiple outlet power strip.

Due to the monitor's internal battery, power may be present even when disconnected from the AC Main Power. When necessary, disconnect the internal battery prior to performing service.

For continued protection against fire hazard, replace fuses with same type and rating only.

An explosion hazard exists if the monitor is used in the vicinity of flammable anesthetic gases.

Do not operate the monitor in ambient temperatures above 40°C or below 5°C. Storage and transport specifications are: Temperature = -10°C to 40°C, Humidity = 0% to 90%, Pressure = 500 to 1060hpa.

The SureTemp temperature probe (Option OPT54-SE) can overheat if the cable is not properly installed.

Always follow proper electrostatic discharge (ESD) procedures during component and assembly handling to prevent static discharge damage to sensitive parts.

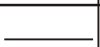
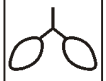
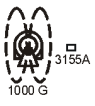
Use only replacement parts specified in this manual or parts preapproved for use by Invivo)MDE for use with this monitor; ensure that defective or worn parts are properly disposed of in accordance with local regulations.

When cleaning the unit, do not permit liquid to enter the case. When cleaning, use proper materials and ensure total dryness before powering the monitor. Use care that cleaning fluids do not attack plastic or painted surfaces (e.g., avoid ammonia, phenol or acetone based cleaners that may damage the monitor surface). Use care that wiping rags do not abrade the surfaces.

In general, handle all Printed Circuit Boards by their edges. Oils, sweat, dirt, etc. can induce leakage paths in high impedance circuits which impede their operation. Such contamination will also promote corrosion of circuits yielding a long term reliability problem.

Avoid rough handling of all exposed chassis parts and front panel overlay. These parts can be scratched causing obtrusive cosmetic defects.

LIST OF SYMBOLS

	Attention, Consult Accompanying Documents		Defibrillator-proof Type CF Equipment (IEC 60601-1) Protection Against Shock		1 (Rotate Counter-clockwise to Open) 0 (Rotate Clockwise to Close)
	Patient Gas Input		Defibrillator-proof Type BF Equipment (IEC 60601-1) Protection Against Shock		Locked
	ON (Main Power)		Type CF Applied Part		Unlocked
	OFF (Main Power)		Alarms ON		Latex-free Materials Are Used
	"ON" (For Part of the Equipment)		Alarms Silenced		Direct Current
	"OFF" (For Part of the Equipment		Heart Beat Detected		Weight
	Alternating Current		Breathing Effort Detected		Dangerous Voltage
	Class II Equipment		Not MRI Compatible		Patient
	Up/Increment	$\%SpO_2$	Percent Oxygen Pulse Saturation		Communication is Not Linked
	Down/Decrement		Earth (Ground)		Communication is Linked
	Input/ Output		Fuse		Replace Fuses as Marked
SN	Product Serial Number	REF	Product Part Number	IPX7	Watertight Equipment
	Attention! Precautionary Alert		Danger! High Voltage		Attention: Electrostatic Safety Device Observe Precautions
1998	Date of Manufacture		Antenna		Battery
	Equipotential Connection	0413	Indicates that the device conforms to the Medical Device Directive		Single Patient Use Only Do Not Reuse
 3155A 1000 G 3155A 1000 G	Do Not Bring Within 1000 Gauss Line		No European harmonized standard exists for the transmission frequencies used for medical telemetry. Potential restrictions may apply within one or more European (EU) member states.		

SECTION 2
CONTROLS AND INDICATORS

2.0 CONTROLS AND INDICATORS.

2.1 Escort M10 General Description. Control of the monitoring features is provided through the use of a Rotary Knob; as the operator turns the Rotary Knob (either clockwise or counterclockwise) with each detent the next Vital Sign Display becomes highlighted (selected) and, when the appropriate display is selected, pressing the Rotary Knob will bring up the menu for the selected parameter.

For adjustment of the Operational Features, the front panel provides several Direct Control Keys; each of these keys performs a fixed function regardless of the monitoring scenario.

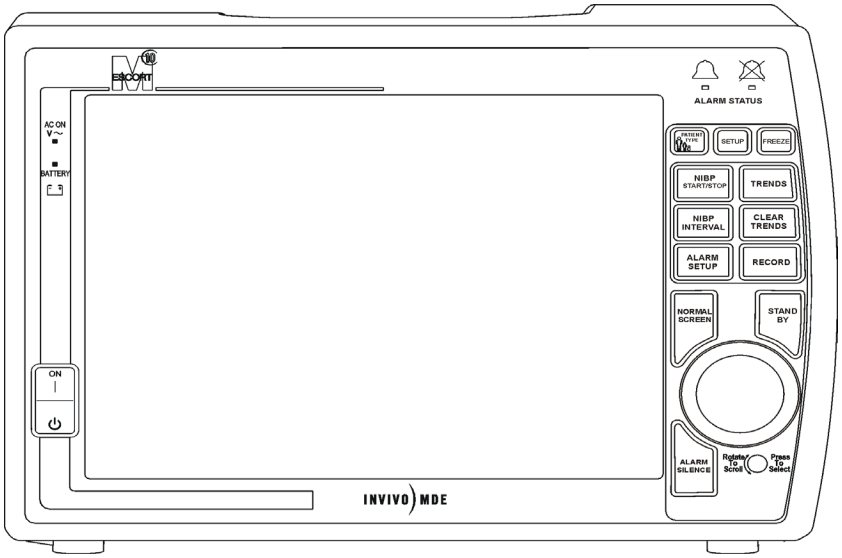


Figure 2-1. The Front Panel

2.1.1 Front Panel Controls and Display. (**See Figure 2-1**) The **Escort M10 Patient Monitor** front panel contains all the controls necessary for complete patient monitoring. Control is provided by pushbutton keys and a Rotary Knob. The following is a general description of the monitor front panel.

a. **Controls.** The monitor front panel contains all the Controls required to operate the patient monitoring features. Control is provided with a Rotary Knob, one (1) Power Control button and twelve (12) Fixed Function Keys. The monitor controls are described below:

(1) **The Rotary Knob.** The Rotary Knob is located to the right of the Display Screen. The function of the Rotary Knob is menu specific. For this reason, its various functions are described throughout this document where it is used; in general, however, the Rotary Knob operates as described below:

(a) As the Rotary Knob is rotated, either clockwise or counterclockwise, the monitor display "scrolls" through the various screen items (patient parameters, menu options and patient parameters) which are available for selection. When the appropriate item is "highlighted," it may be selected by pressing and releasing the Rotary Knob.

(b) During normal operation each available parameter is displayed on the screen. When the Rotary Knob is rotated, the parameter name which is being pointed at becomes "highlighted." Rotating the Rotary Knob will cause the monitor to "scroll through" the available parameters, highlighting each in turn. Once the desired parameter is highlighted, pressing the Rotary Knob completes the selection and brings up the menu for that parameter. When a menu is selected, rotating the Rotary Knob will scroll through the menu items until the desired item is highlighted, at which time pressing the Rotary Knob will select that item.

(2) **ON/Power Standby Button.** The **ON/Power Standby Button** allows the monitor to be turned ON or placed into the Power Standby Mode. To turn on the display and initialize the monitor, press and release the **ON** side of the button. To place the monitor into the Power Standby Mode, press the other side of the button. While in Power Standby the batteries will continue to charge as long as the monitor remains connected to the AC Power Source.

NOTE

The Fixed Function Keypad graphic (Figure 2-2) has been created for best presentation in this manual and are not intended to exactly match the look of the keys on the monitor. Figure 2-2, and all other drawings in this manual, may not precisely match the actual monitor.

(3) **Fixed Function Keys.** (**See Figure 2-2**) There are three sets of Fixed Function Keys. The first set is located at the top of the keypad and contains three (3) keys (**PATIENT TYPE, SETUP** and **FREEZE**) that are used to control Operational Features of the monitor. The second set is located in the middle of the keypad and contains six (6) keys (**NIBP START/STOP, TRENDS, NIBP INTERVAL, CLEAR TRENDS, ALARM SETUP** and **RECORD**) that are used to control Patient Parameter Monitoring features of the monitor. The third set contains three (3) keys located around the Rotary Knob (**NORMAL SCREEN, STAND BY** and **ALARM SILENCE**) that, like the first set, are used to control Operational Features of the monitor. The Fixed Function Keys are described below:

(a) **PATIENT TYPE (Item 1).** The **PATIENT TYPE** key is used to select or display the current patient type. The selections are **ADULT, PED,** and **NEO**.

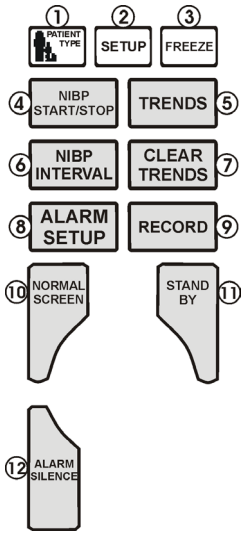


Figure 2-2. The Fixed Function Keys

(b) **SETUP (Item 2).** The **SETUP** key is used to change the monitoring conditions that the monitor is currently set up for.

(c) **FREEZE (Item 3).** The **FREEZE** key "freezes" all displayed waveforms for evaluation purposes. Pressing the **FREEZE** key a second time will release the waveforms.

NOTE

Waveforms cannot be frozen during recording. Initiating a recording will release the frozen waveforms.

(d) **NIBP START/STOP (Item 4).** The **NIBP START/STOP** key is used to initiate a NIBP measurement or to stop a measurement in progress.

(e) **TRENDS (Item 5).** The **TRENDS** key is used to access the **TREND SETUP** menu for configuration of the trending feature.

(f) **NIBP INTERVAL (Item 6).** The **NIBP INTERVAL** key is used to set the interval between automatic NIBP measurements.

(g) **CLEAR TRENDS (Item 7).** The **CLEAR TRENDS** key is used to clear the parameter Trend file.

(h) **ALARM SETUP (Item 8).** The **ALARM SETUP** key is used to set the Alarm Limit adjustments for all the available parameters.

NOTE

A Bell Symbol next to the listed parameter indicates that one or more alarms for that parameter are **ON**. An X is displayed through the Bell Symbol when all alarms for the associated parameter are **OFF**.

(i) **RECORD (Item 9).** Pressing the **RECORD** key initiates a 16-second recording of any one parameter or two parameter waveforms with one parmeter always being the ECG parameter waveform. To stop a recording in process, press **RECORD** prior to completion of a manual or alarm recording. Highlight parameter first with the rotary knob. If no parameters are selected after pressing record, a 16-second strip of ECG waveform will be recorded.

NOTE

Active waveforms (i.e., parameters currently being monitored) do not need to be displayed in order to acquire a recorded waveform.

(j) **NORMAL SCREEN (Item 10).** The **NORMAL SCREEN** key will return the monitor display from any menu to the normal monitoring screen.

(k) **STAND BY (Item 11).** Pressing the **STAND BY** key places the **Escort M10** monitor into the Standby Mode. The monitor stays in Standby Mode until the **STAND BY** key is pressed a second time. Except for the three (3) key features given below, the monitor operates normally by continuing to provide current patient information on the Display Screen.

While in Standby Mode:

- All audible alarms are disabled. The disabled alarms are indicated on the screen by the "**X**" through the bell shaped Alarm Status Symbol.
- Active NIBP automatic measurements are suspended.
- No automatic printout or VSC entry is generated.

(l) **ALARM SILENCE (Item 12).** The **ALARM SILENCE** key will temporarily silence any active Alarm Tones. The Factory Default for the interval in which the Alarm Tone will be suspended are 180 seconds in the Adult Mode, 90 seconds in the Pediatric Mode and 60 seconds in the Neonatal mode.

If an alarm limit is violated, pressing **ALARM SILENCE** key will silence the alarm tone. Pressing the key again before the suspend time period has elapsed will reactivate the audible alarm tones if the alarm condition still exists.

While alarms are suspended, the following message will appear on the monitor screen:

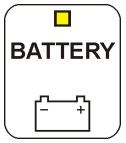
ALARMS SUSPENDED *XXX*

(***XXX*** above represents the number of seconds remaining until the Alarm Silence condition is removed.)

b. **Front Panel Displays.**

(1) **Indicators.** The monitor front panel includes three indicators that illuminate to notify the operator of a specific activity or situation. The indicators are AC On, Battery charge status and Alarm Status. The indicators are described below:

(a) **AC ON.** The green AC ON LED (Light Emitting Diode) illuminates when the monitor is connected to AC power.



(b) **BATTERY.** The yellow **Charging LED** illuminates when the monitor's batteries are charging. The **Charging LED** will not be illuminated when the batteries are fully charged, or when the monitor is not connected to AC power.

(c) **ALARM STATUS.** When the LED below the Alarm Status Bell Symbol is flashing, one or more parameters are alarming. When the LED below the Alarm Status Bell Symbol with the X through it is ON, either one (1) or more active Alarms are Silenced or all the Alarms have been turned off.

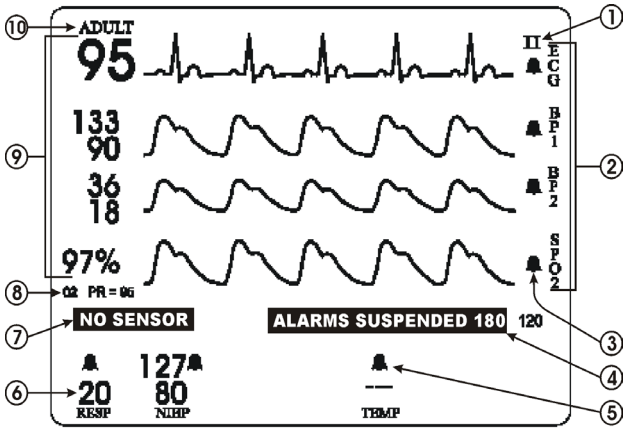


Figure 2-3. The Normal Screen

(2) **Display Screen.** (**See Figure 2-3**) The **Escort M10** Display Screen contains three different types of information: 1) the Waveform Display Zone contains parameter waveforms, 2) the Numeric Only Display Zone contains parameter numerics and 3) there are two message areas that display system information when required. The Display Screen is described below:

(a) **ECG Lead in Use (Item 1).** Indicates the ECG lead displayed in the top trace of the Waveform Display Zone. Choices include lead I, II, III, or V LD (for "chest lead" in a 5-lead configuration). If heart rate is being derived from SPO2 or Invasive Blood Pressure, *PULSE* is displayed.

(b) **Icon Labels for Parameters in the Waveform Display Zone (Item 2).** The Icon Labels specify the parameters displayed in the Waveform Display Zone and are used, in conjunction with the Rotary Knob, for selecting the individual parameters for user configuration.

(c) **Alarm Status for Parameters in the Waveform Display Zone (Item 3).** Each Bell Symbol displayed in the Waveform Display Zone indicates the alarm **ON/OFF** status for the parameter adjacent to it. If a solid Bell Symbol is displayed, one or more of the associated alarms are ON. If a Bell Symbol with an X through it is displayed then the alarms are OFF for that parameter.

(d) **System Message Area (Item 4).** A message that is not specific to a single parameter, such as **"ALARMS SUSPENDED 180,"** is displayed in a reverse-video box (Black letters inside a White filled box) just below the Waveform Display Zone. Message display is temporarily obscured when a parameter or system setup page is displayed. In the **Normal Screen** state, the message continues to be displayed as long as the message condition exists.

(e) **Alarm Status for Parameters in the Numeric Only Display Zone (Item 5).** Each bell displayed in the Numeric-Only Display Zone indicates the alarm **ON/OFF** status for the parameter listed below it. If a solid Bell Symbol is displayed, one or more of the associated alarms are ON. If a Bell Symbol with an X through it is displayed then the alarms are OFF for that parameter.

(f) **Numeric Only Display Zone (Item 6).** The parameter Icon labels displayed at the bottom of the front panel specify the parameters displayed in this zone. The numeric data associated with the parameters are displayed above the parameter labels in the Numeric-Only Display Zone.

NOTE

In the **Normal Screen** state, the parameter labels and numeric data are displayed at the bottom of the screen. When a parameter or system setup page is displayed, the Numeric-Only parameter labels and associated data are displayed slightly above the setup page.

(g) **Message Area for Parameters in the Numeric Only Display Zone (Item 7).** Messages concerning parameters in the Numeric Only Display Zone are displayed in a reverse-video box on the left side of the screen (Black letters on parameter color backround). Message display is temporarily obscured when a parameter or system setup page is displayed. In the **Normal Screen** state, the message continues to be displayed as long as the message condition exists.

(h) **Message Area for Parameters in the Waveform Display Zone (Item 8).** Messages concerning parameters displayed in the Waveform Display Zone are displayed in a video box below the numeric data for the corresponding waveform parameters. The message is displayed as long as the message condition exists.

(i) **Waveform Display Zone Associated Numerics (Item 9).** The Waveform Display Zone displays waveform traces and associated numeric data for as many as four different parameters. The top waveform trace is reserved for the ECG waveform; different parameters may be assigned to the other three waveform traces.

To display five (5) waveforms, the fourth and fifth waveforms must be Invasive Blood Pressures.

(j) **Current Monitoring Mode - Patient Selected (Item 10).** The current monitoring mode is displayed at the top of the screen — **ADULT, PED,** or **NEO**. The monitoring mode can be changed through the system function key **PATIENT TYPE**.

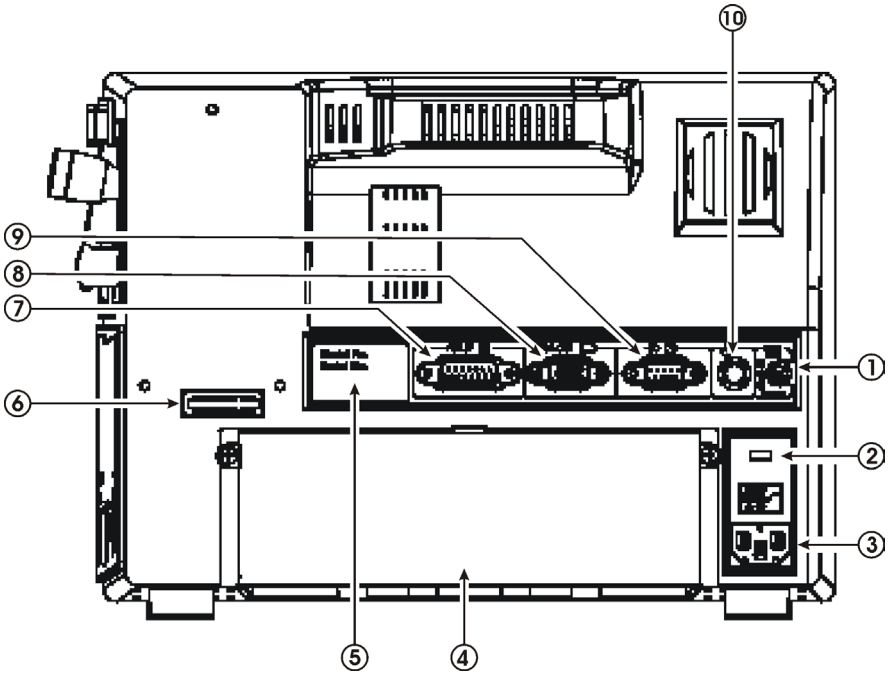


Figure 2-4. Back Panel Connections

2.1.2 Back Panel Connections. (**See Figure 2-4**) The following is a description of the items located on the monitor back panel:

a. **External DC Input (12 - 28V) Connector (Item 1).** Allows an external DC power source to be connected for extended use during transport where AC power is not available. Batteries are also charged with external DC power.

b. **Fuse Holder and Fuse Replacement (Item 2).** The fuse holder contains the fuses for the monitor. Open the door of this holder to replace fuses. It is recommended that qualified technical service personnel replace fuses when necessary.

WARNING

For protection against fire, replace the fuses only with those of the same type and rating.

The Escort M10 requires two identical slow blow T2.5A / 250V fuses for operation. Ensure that the AC power cord has been disconnected before replacing fuses. Carefully open the door of the fuse holder with a short 1/8" flat screwdriver. Replace the blown or defective fuse with one of the same type and rating. Noting orientation, gently slide the fuse holder back until it locks snugly into its original place. After the fuse replacement, connect the AC power cord to the Escort M10. The unit is now ready for operation.

c. **AC Power Cord Input Connector and Optional Power Cord Mounting Bracket (Item 3).** Allows connection of the AC power cord to the monitor. In addition, the AC power cord must be plugged into an AC source before the monitor can operate on AC power and before the batteries can be charged.

For permanent connection, the power cord bracket should be installed. See Figure 2-5 for instructions on installing the power cord mounting bracket.

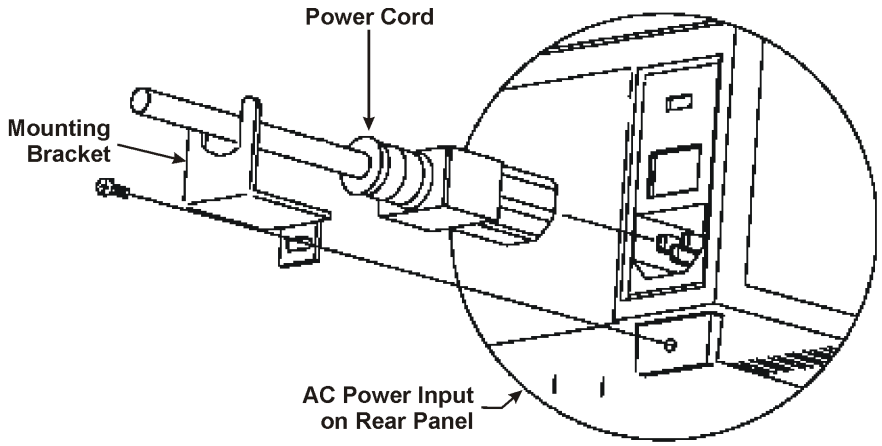


Figure 2-5. Optional Power Cord Mounting Bracket Installation Diagram

d. **Battery Compartment (Item 4).** This compartment houses one battery (or up to two batteries on earlier units) which provide power in transport situations or when AC power is not available.

e. **Model & Serial Number Label (Item 5).** This label contains the model number and serial number of the monitor.

f. **Add-On Module Interface (Item 6).** If a transceiver module is connected here, wireless communications between the monitor and an Invivo)MDE Central Station can be established.

If a telemetry receiver module is connected, communication between the monitor and an ambulatory transmitter can be established.

If a CIS module is connected, communication to a hospital information system computer can be established, or RS232 communications can be established.

g. **Auxiliary Output Connector (Item 7).** Provides analog waveform or alarm relay closure interface signals from the Escort M10 to other clinical instruments.

WARNING

When connecting the Escort M10 to any other instrument, verify proper operation before clinical use. Refer to the other instrument's Operations Manual for complete instructions.

h. **VGA Output Connector (Item 8).** Allows for an external VGA monitor to be connected. The same information that is displayed on the Escort M10 monitor will display on the external VGA monitor. Output resolution is 640 x 480 pixels.

i. **Serial Interface - ISP Port (Item 9).** This port is used to upload and download software data from external sources.

j. **Equipotential Connector - Grounding Terminal (Item 10).** Provides grounding for the monitor when the monitor is used with other medical equipment. It must be used as a protective ground terminal when the monitor is operated with external DC power.

2.1.3 Side Panel Parameter Connections. (**See Figure 2-6**) The Patient Parameter inputs are located on the monitor side panel along with the recording unit. The following is a description of the monitor side panel:

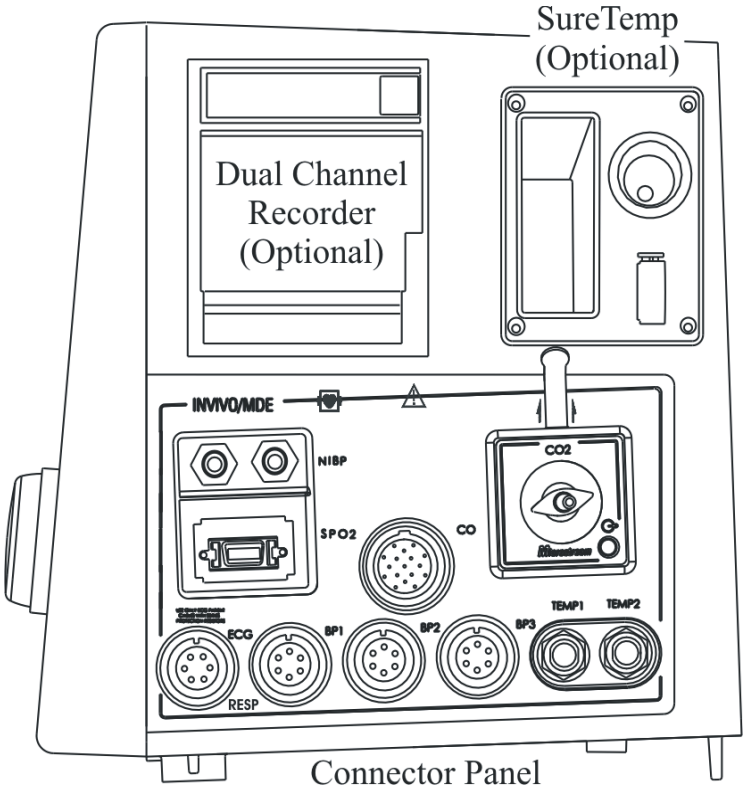


Figure 2-6. The Side Panel

a. **Connector Panel.** The Escort M10 can monitor several parameters. The available parameters (depending on options) include **ECG, SPO2, IBP (Invasive Blood Pressure), NIBP (Noninvasive Blood Pressure), Respiration, ETCO2, Cardiac Output** and **Temperature**.

b. **Dual Channel Recorder.** The optional Recorder unit provides manual and alarm recordings of any one or two waveforms simultaneously.

c. **SureTemp Unit.** The optional SureTemp unit allows the taking of a patient's temperature with the different types of SureTemp probes and measurement sites.

2.1.4 Modular Components. (**See Section 11.1)**

SECTION 3
POWER SOURCES

3.0 POWER SOURCES.

WARNING

Always locate the Escort M10 monitor and its power cord away from any electrosurgery equipment and its power cord cables.

3.1 Power Module. There are three options for providing power to the Escort M10 monitor: AC, Battery and External DC power. These options and their requirements are described in the following paragraphs.

WARNING

When operating the monitor from an AC power source, the wall receptacle must be a three-wire, grounded hospital grace AC power plug and cord, or an equivalent hospital grade plug and cord. If in doubt about the integrity of the grounding of the main supply connection, the unit should be operated solely on battery power.

3.1.1 AC Power. If the Escort M10 monitor is operated solely on AC power, ensure the following requirements are met:

a. The fuses in the fuse holder on the rear panel must be appropriate for the line power to which the monitor is connected -- 115VAC or 230 VAC.

b. The monitor power cord is connected to both the monitor and AC power source.

NOTE

For permanent connection, the MDE power cord bracket should be installed.

If the above requirements are met, the AC ON LED should be illuminated. If the above requirements are met and the LED is not illuminated, qualified service personnel should inspect the monitor and connection.

3.1.2 Battery Power. Power to the Escort M10 monitor may be supplied by utilizing the internal battery. The battery transform the Escort M10 into a fully functional, portable monitor available for use in various transport situations.

The battery utilized in the Escort M10 monitor is a 7.0 AH for the current type single (black) battery. Fully charged battery should measure approximately 13.0 to 13.5 Volts DC with an open load.

The Escort M10 will indicate battery status on screen as **BATTERY HI**, **MID**, **LOW** or **VERY LOW**. Battery status may be viewed from the **TEST** page when **SW STAT INFO** is selected and the monitor is running on battery power.

Battery charging circuitry is located on the Power Supply Board. See Section 4, "Power Supplies," for details.

NOTE

Never discharge the battery completely. To ensure long battery life, always recharge battery or batteries immediately after use. Battery should be replaced every two (2) years regardless of test results. Used battery should be recycled or disposed of properly in accordance with local regulations.

The monitor accommodates one (1) rechargeable sealed lead-acid battery (Invivo/MDE Part Number E2700-37SE7).

The following guidelines apply when operating the monitor with battery power:

- Maximum operating time with one fully charged battery (current type sealed lead-acid battery) is 3.5 hours.
- Use of the monitor's recorder will shorten operating time 5 minutes for every minute the recorder runs.
- The battery or batteries will automatically recharge if the monitor's AC power cord is connected to AC power source. The front panel **AC ON** LED will illuminate when the monitor is connected to AC power source. The front panel CHARGING LED will illuminate when the batteries are charging and will be OFF when the batteries are about 90% charged.

NOTE

Neither the AC ON nor the CHARGING LED will be illuminated when the monitor operates on battery power alone.

- Monitor charges fully depleted batteries (current type sealed lead-acid battery) to a 90% charge in approximately 8 to 10 hours.
- When you turn the monitor **ON** and it is powered by battery alone, the monitor displays one of the battery level messages listed in Table 3-1. The message will be displayed for thirty (30) seconds on the system message line.

NOTE

Battery cycle life (operating time) is dependent on battery usage and maintenance. To maximize battery cycle life, do the following:

a. Operate the monitor with AC power whenever possible.

b. Always charge the battery or batteries when the monitor is not being used.

c. Immediately charge the battery if the level reads **LOW** or **VERY LOW**.

d. Replace battery or batteries after two years of use.

Table 3-1. Battery Power Levels

Message	Battery Level
MONITOR BAT HI	>60% Charge
MONITOR BAT MID	20% to 60% Charge
MONITOR BAT LOW	<20% Charge

Table 3-1. Battery Power Levels (Continued)

Message	Battery Level
BATTERY VERY LOW (Intermittent Alarm Tone Sounds)	Approximately 10 minutes of battery life remains

3.1.3 Removing/Reinstalling Battery in the Monitor. To remove and replace the battery in the monitor, perform the following steps:

a. Turn the monitor OFF by pressing the **Power Standby** key.

b. Disconnect power cord and / or external DC source from the unit.

c. Locate the battery cover at the bottom rear location of the unit. Refer to Figure 3-2.

d. Remove the five (5) screws securing the battery cover to the chassis.

e. Carefully remove the battery cover by lifting the bottom rear edge.

f. Slide the battery out of the battery compartment and disconnect the cable from the battery interconnect.

g. Mount bracket assembly on new battery.

h. Connect cable assembly to new battery and to battery interconnect cable as shown in Figure 3-8. Then slide assembly into battery compartment (route cables as shown in Figure 3-8).

i. Reinstall the battery cover and secure with the five (5) screws.

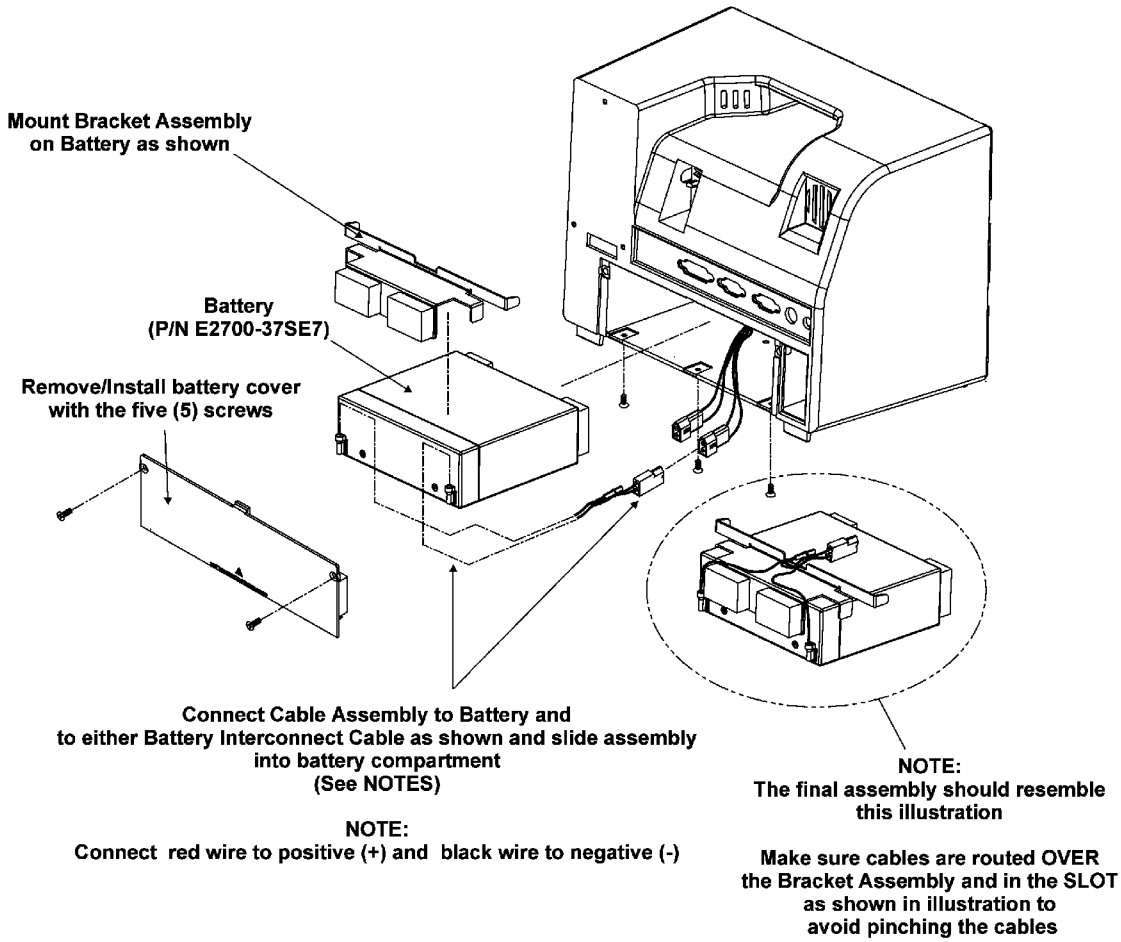


Figure 3-8. Removing/Replacing Battery

3.1.4 Initial Battery Test and Charge/Discharge Instructions.

a. Press the **ON** key on front of monitor and verify the unit will power on.

b. Press the **Power Standby** key on front of monitor and turn unit off.

c. Connect the monitor to AC power and verify the Battery Charging LED is illuminated.

d. The following label (Figure 3-9) appears on the battery. Follow the instructions on the label carefully to ensure maximum battery life and performance.

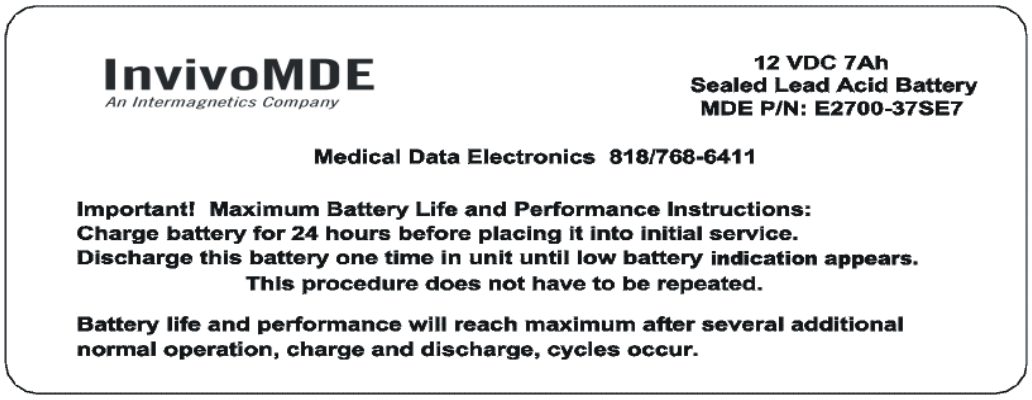


Figure 3-9. Battery Label

3.1.5 External DC Power. An auxiliary connector (center pin positive) labeled **DC IN 12-28V, 30VA** is located on the rear panel of the monitor. This allows connection to an external DC power source when AC power is not available. The external DC power source will also charge the internal batteries.

WARNING

When using an external DC power source, the equipotential connector must be used as a protective ground terminal.

NOTE

Before utilizing the external DC input connector (Figure 3-10), refer to the label surrounding the "DC IN" input connector for correct voltage polarity.

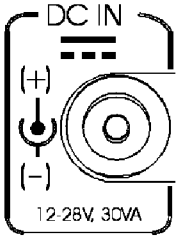


Figure 3-10. DC Input Connector

3.1.6 Turning On the Monitor. Perform the following steps to bring the monitor on line for use:

a. Connect the Power Cord to the A/C Power Cord Connection plug on the monitor back panel.

b. Ensure that the Front Panel Power Switch is set to the **Power Standby** (Off) position.

c. Install the Sealed Lead Acid Battery.

d. Plug the Power Cord into an appropriate facility power source.

e. Set the Front Panel Power Switch to the **ON** position.

f. It is recommended to allow the Battery to charge a minimum of 8 hours before utilizing the monitor for transport use. For normal use the monitor should be plugged into an electrical outlet and not on battery power.

SECTION 4
POWER SUPPLY BOARDS

4.0 POWER SUPPLY BOARDS.

4.1 OEM Power Supply. The monitor's OEM Power Supply converts the input AC voltage to 15VDC. The 15VDC output goes directly to the main power supply connector P1. The input to the OEM Power Supply is fed from the power module. The AC input of 115/230VAC is autosensed by the OEM Power Supply. Frequency selection to the monitor is performed on the CPU board.

4.2 Main Power Supply. The Main Power Supply provides the flexibility to operate the unit via three inputs: AC (alternating current), external DC, or battery. The Main Power Supply will charge the battery or batteries while on AC or external DC supply. Isolated and non-isolated voltages are created on the Main Power Supply for use throughout the monitor. Fan control, battery level-detect, and low voltage shutdown circuitry are also contained on the Main Power Supply.

4.2.1 Inputs. The Main Power Supply utilizes any one of three inputs. These inputs are 15VDC from the OEM Power Supply at P1, external DC source (12 – 28VDC, 30VA) at P2, and battery input (10-13VDC) at P3. Inputs from the OEM Power Supply and the external DC become filtered and rectified. This voltage is then referred to as VBATT. VBATT will be approximately 11 – 15VDC depending upon the input source. When the power supply is energized by the OEM Power Supply, the **AC ON** LED will be illuminated on the front panel. The input from the CPU board is PS_SYNC. This is a 250 kHz signal for noise reduction throughout the monitor. Inputs from the front panel membrane **ON/STBY** key will enable the control relay to turn the system **ON** or **OFF**.

4.2.2 Voltage Creation. Voltage creation starts when the operator touches the "**ON**" key on the front panel. This latches the control relay on the power supply and sends the signal VBATT to the input of the pulse width modulator (PWM). The PWM will enable the power mosfets into switching VBATT through the primary of the transformer. Output voltages are then filtered and rectified before being transferred to the CPU board. Two windings of the transformer are for creating isolation voltages. A third winding is for creating the non-isolation voltages.

4.3 Battery Charging. All battery charge functions are controlled on the Main Power Supply. The battery is charged from input AC or external DC sources. Maximum charge current is 2.5 amperes. Charge voltage is ~15VDC and for charge currents greater than 250 mA. When the unit is charging above 250 mA, the battery charging LED will be illuminated on the front panel. A floating charge voltage of ~14VDC occurs when the battery is approximately 90% charged. The float charge current will be below 250 mA. Charge time for current battery configuration is approximately 8 to 10 hours to 90%.

4.4 Battery Level. On board the power supply is a comparator circuit for detecting and reporting the battery level to the CPU board. The signals to the CPU board are BAT_CON1 and BAT_CON0. Refer to Table 4-1 for battery voltage indicator levels. These signals can be measured on connector JP1. The battery level will be displayed for 30 seconds when initially operating on battery power. After 30 seconds, the battery level status can be viewed on the **TEST / STAT INFO SW** page (Find and press the **SETUP** Menu-Select key, select **MORE** twice, select the **TEST** option, then **STAT INFO SW**).

Table 4-1. Battery Conditions

Battery Voltage	BAT_CON1	BAT_CON0	Battery Level
12.00 to 12.70	1	1	High
10.98 to 12.20	1	0	Mid
10.04 to 11.10	0	1	Low

Table 4-1. Battery Conditions (Continued)

Battery Voltage	BAT_CON1	BAT_CON0	Battery Level
9.0 to 9.3	BATTERY	SHUTDOWN	

4.5 Fan Control. The monitor controls the internal temperature with a temperature sensor and fan. When the internal temperature reaches 100° F, the temperature switch closes and enables the fan to rotate. The fan control circuitry resides on the Main Power Supply. The fan is located on the rear housing.

4.6 Shutdown Circuitry. There are two methods of shutting down the monitor. The first method is when the operator presses the **Power Standby** (Off) key on the front panel. When this is performed, the control relay enables a ground reference to the PWM's soft start input. This will cease the voltage creation and turn off the power supply. The second method is low voltage shutdown. When the VBATT signal drops below approximately 9.2VDC, a comparator circuit will pull the soft start input to the PWM low, and force the power supply off.

4.7 Outputs. Output voltages from the power supply can be found at connections JP1 and JP2. Non-isolated voltages can be measured at JP1 along with BAT_CON0, BAT_CON1, BCHG LED, and AC LED. Isolated voltages can be found at JP2 along with RESPDRV. RESPDRV is a 125 kHz signal used for creating the respiration signal. Refer to Figure 4-3 and Table 4-2 for correct pin locations of each voltage.

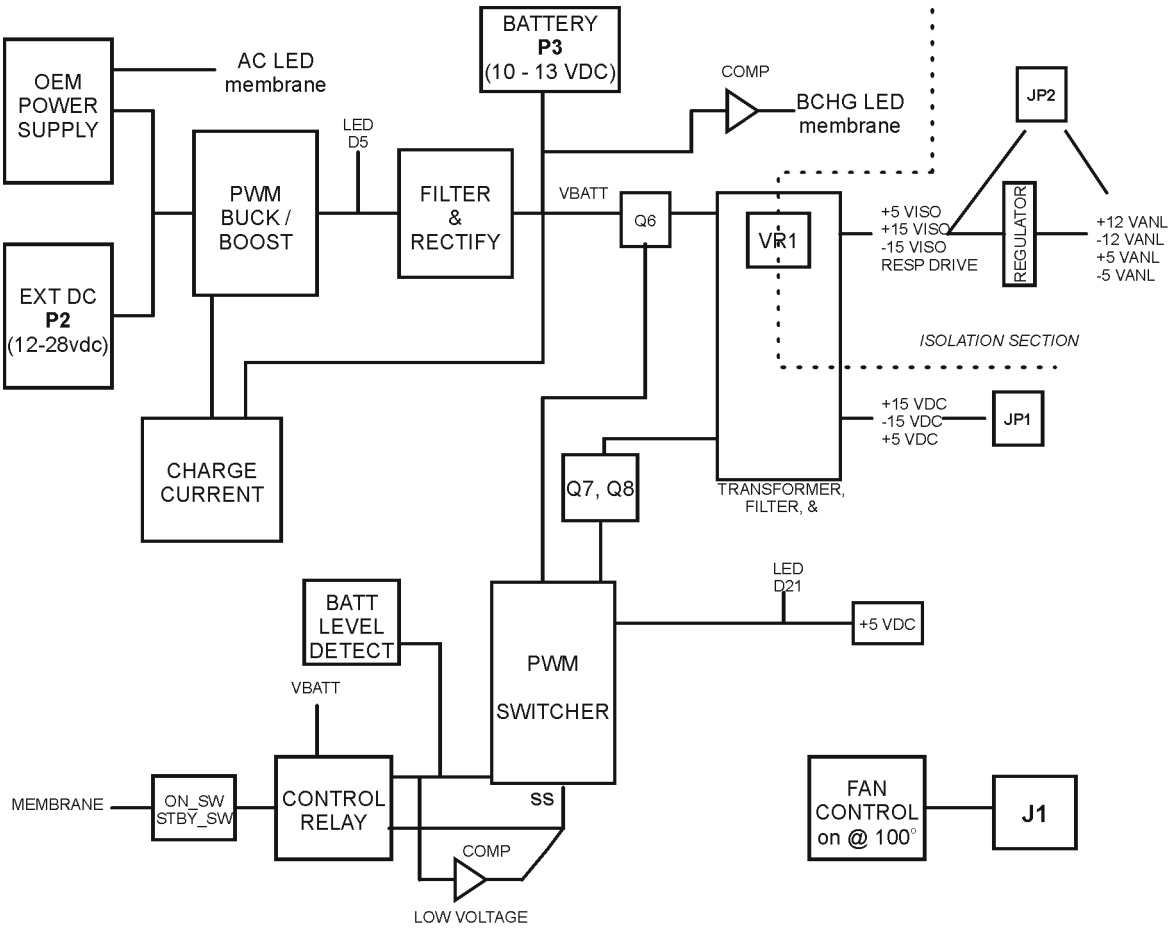


Figure 4-1. Escort M10 Power Supply Block Diagram

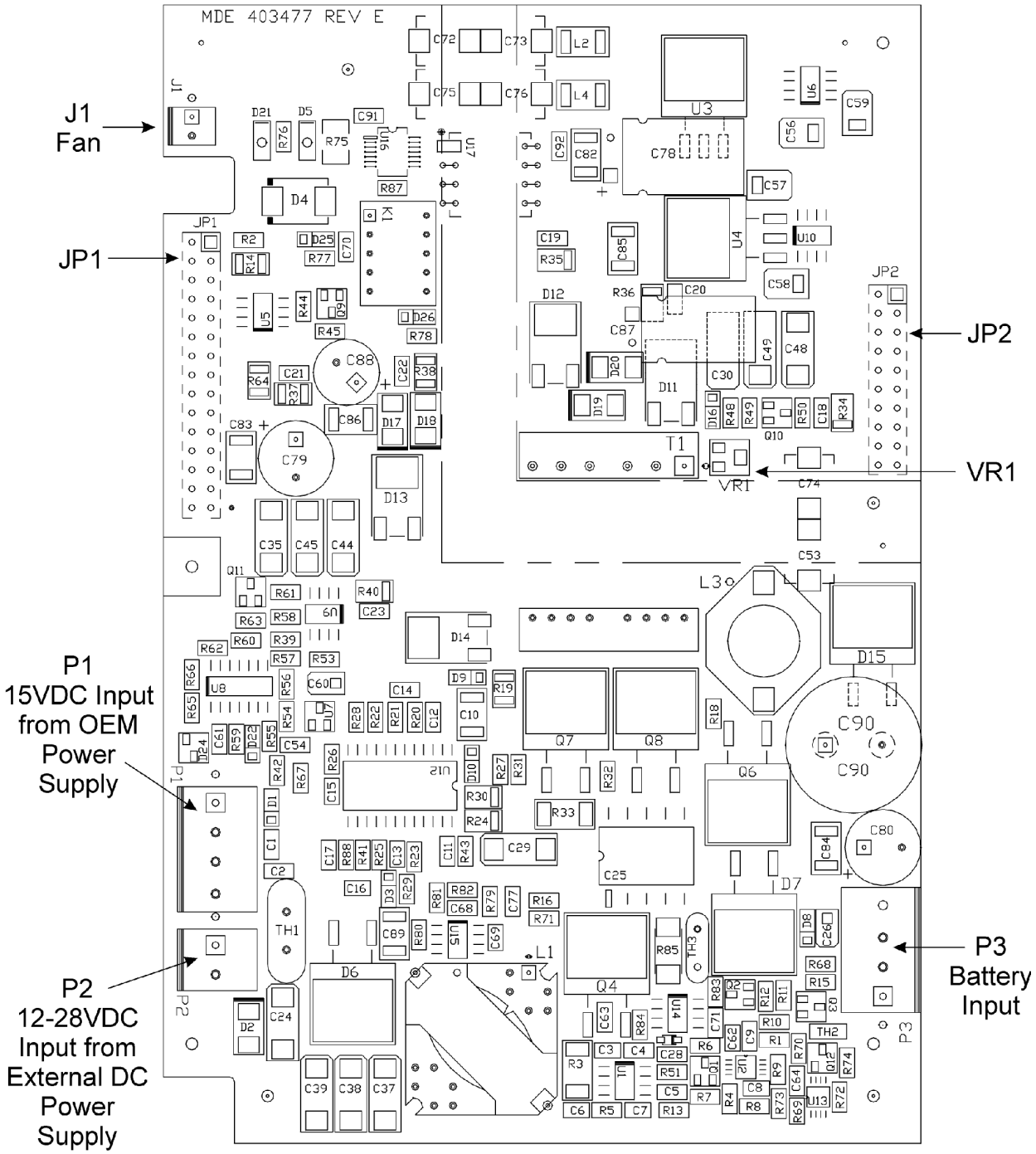


Figure 4-2. Escort M10 Main Power Supply Board Layout

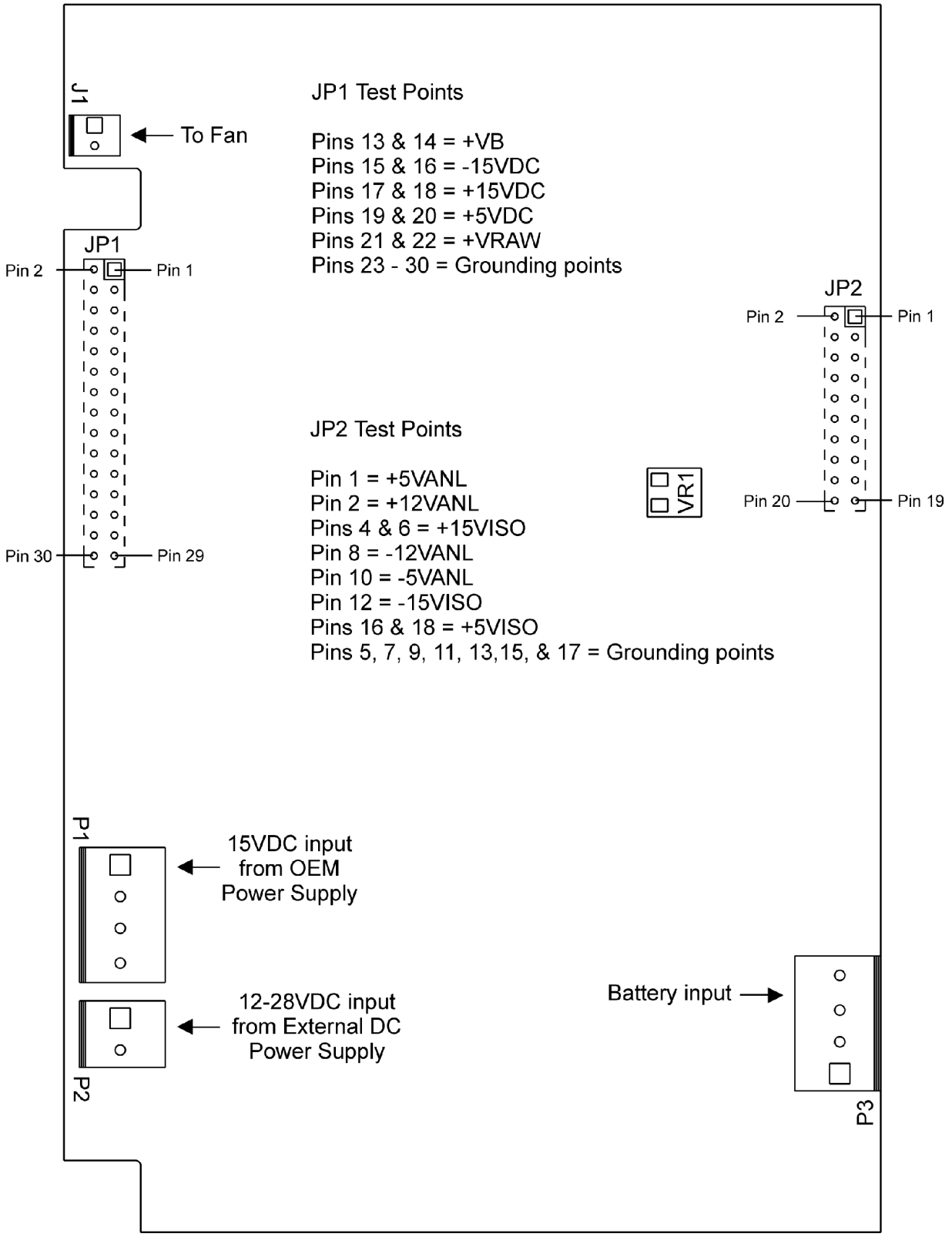


Figure 4-3. Main Power Supply Board Test Points

Table 4-2. Main Power Supply Board Test Points

Connections	Pin Locations	Voltages
JP1	13 and 14	+VB
	15 and 16	-15VDC
	17 and 18	+15VDC
	19 and 20	+5VDC
	21 and 22	+VRAW
	23 through 30	Grounding Points for JP1
JP2	1	+5VANL
	2	+12VANL
	4 and 6	+15VISO
	8	-12VANL
	10	-5VANL
	12	-15VISO
	16 and 18	+5VISO
	5, 7, 9, 11, 13, 15 and 17	Grounding Points for JP2
P1	1 and 2	+15VDC
	3 and 4	Grounding Points for P1

Table 4-3. Main Power Supply Board Adjustments

Adjustments	
VR1	Isolation ground noise adjustment **<1C, page 1>**

SECTION 5
CPU BOARD

5.0 CPU BOARD.

5.1 Overview. The CPU board controls many functions including video display, alarm processing, tone generation, recorder interface, I/O connections, clock functions, reset control, keypad calculations and in system programming (ISP). The Central Processing Unit (CPU) used is a type Z8S180. Configuration is retained in RAM for the Z8S180 CPU via a backup battery. If the backup battery fails, all power up settings will be set to factory defaults. The main processor communicates to the parameter processors via serial bus communications (DBUS). Add on modules also communicate through the DBUS to the main processor. Communications for each parameter and add on module can be verified on the TEST page. Refer to Section 6 **"Parameters"** for further details on each parameter. The software version of the main CPU and parameters are listed on the TEST page.

5.1.1 Display. The monitor uses a multi-color LCD display. A power inverter board is used on the LCD models to illuminate the backlight. The LCD display connects to J16 on the CPU board and the EL display connects to J5 on the CPU board. The power inverter connects to J21 on the CPU board.

5.1.2 Bezel/Membrane. All membrane calculations are handled on the CPU board. The monitor uses a 4 x 5 matrix to determine which key was pressed. Please refer to Figure 5-6 when trouble shooting the membrane. The membrane connects to J20 on the CPU board.

5.1.3 Test Points. Test points are available on the CPU to help troubleshoot and calibrate the monitor. Refer to Figure 5-2 and Table 5-1 for test points and locations.

5.1.4 Adjustments. VR7 adjusts the contrast for 20411 models. VR1 through VR3 are for ECG. VR4 – VR6 are for NIBP / IBP. Refer to Figure 5-3 and Table 5-2 for adjustment locations.

5.1.5 Connections. Refer to Figures 5-4 and 5-5 for the Escort M10 interconnect diagram.

5.1.6 Software Updates. Software updates can be performed utilizing ISP via the I/O connector at the rear of the unit or by physically replacing the components. The main eprom is located at U16. The NIBP/IBP/Temp eeprom is located at U75 and the ECG/RESP eeprom is located at U94. Contact Invivo)MDE's technical support department for further details.

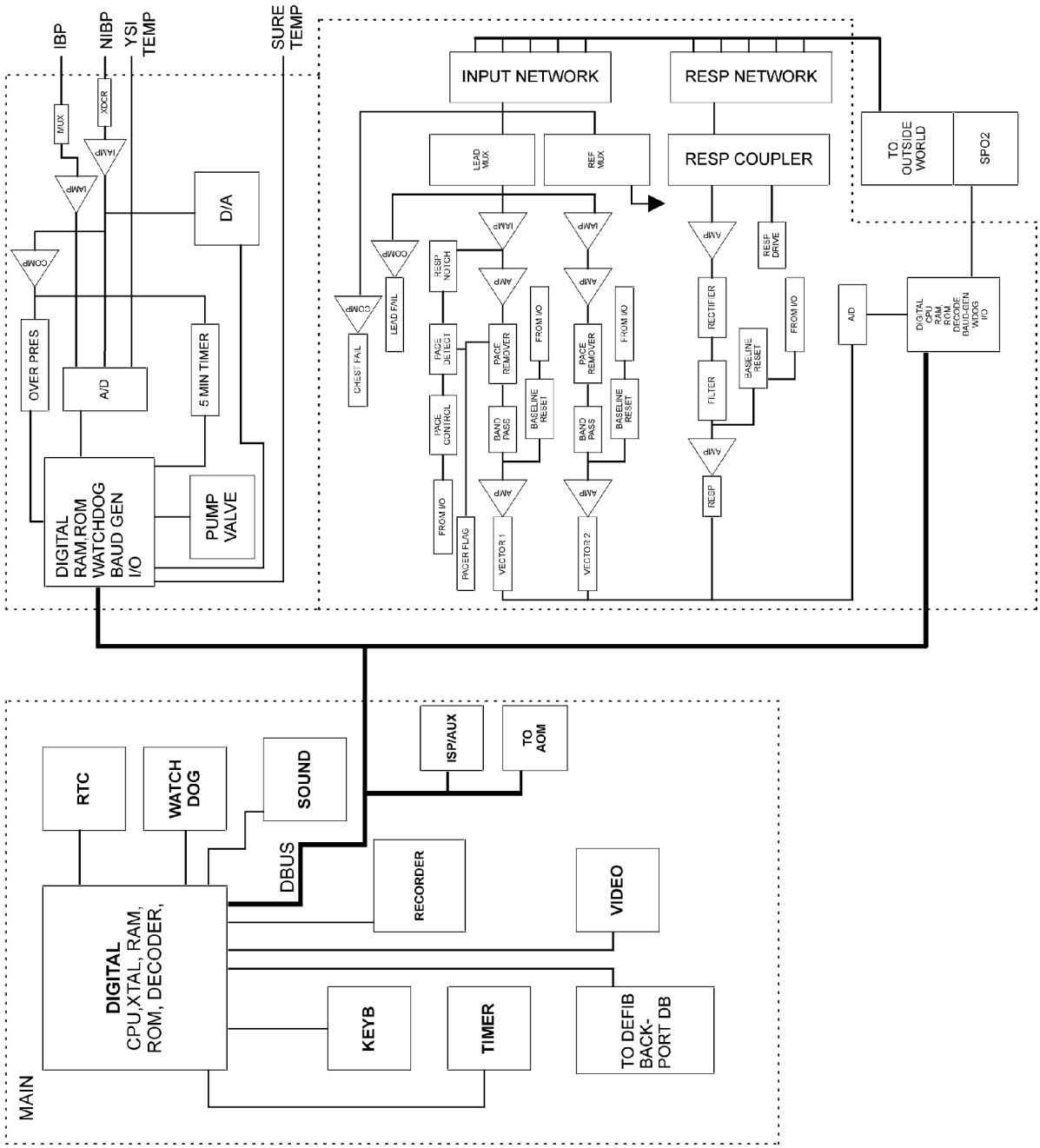


Figure 5-1. Escort M10 CPU Block Diagram

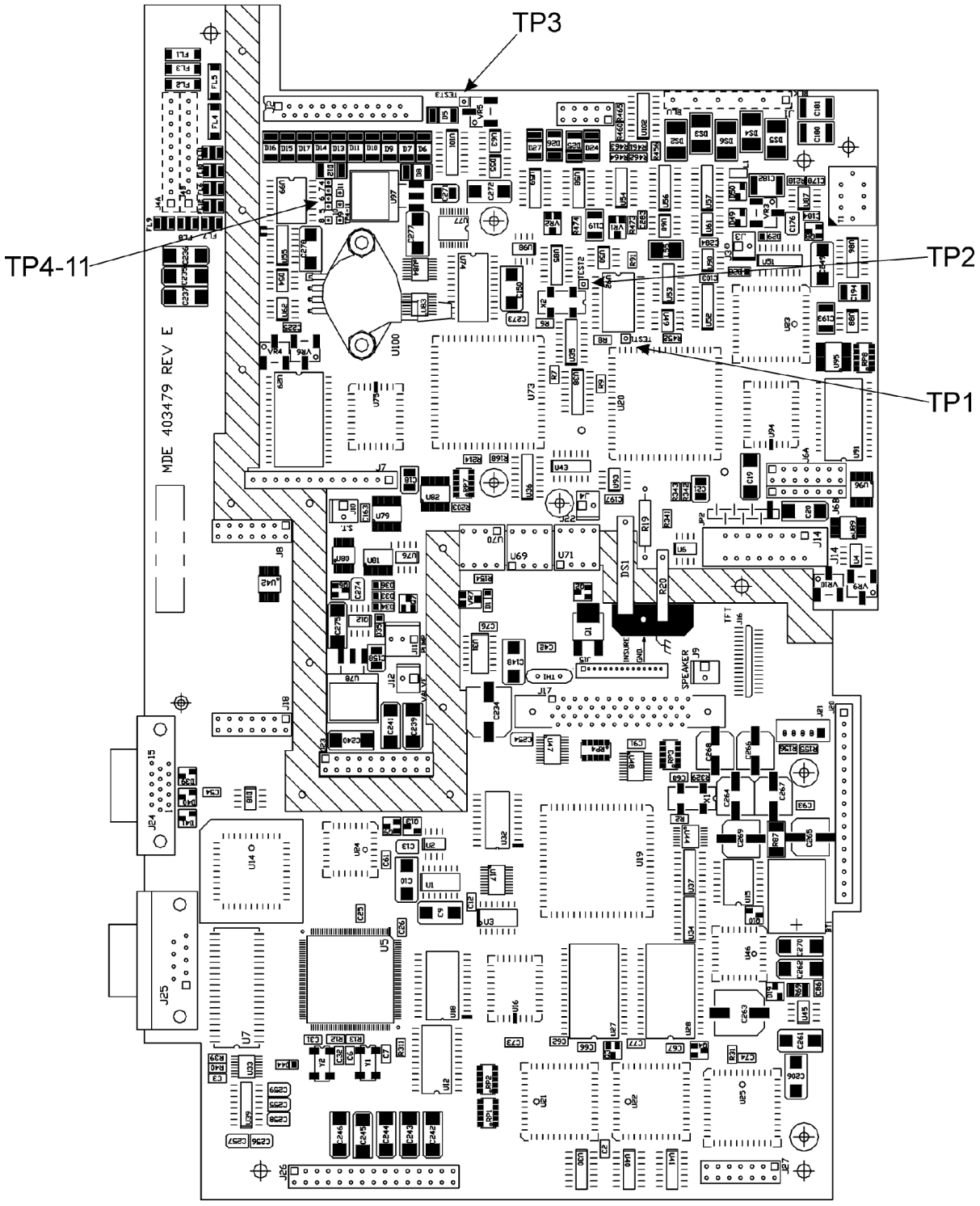


Figure 5-2. Escort M10 CPU Board with Test Points

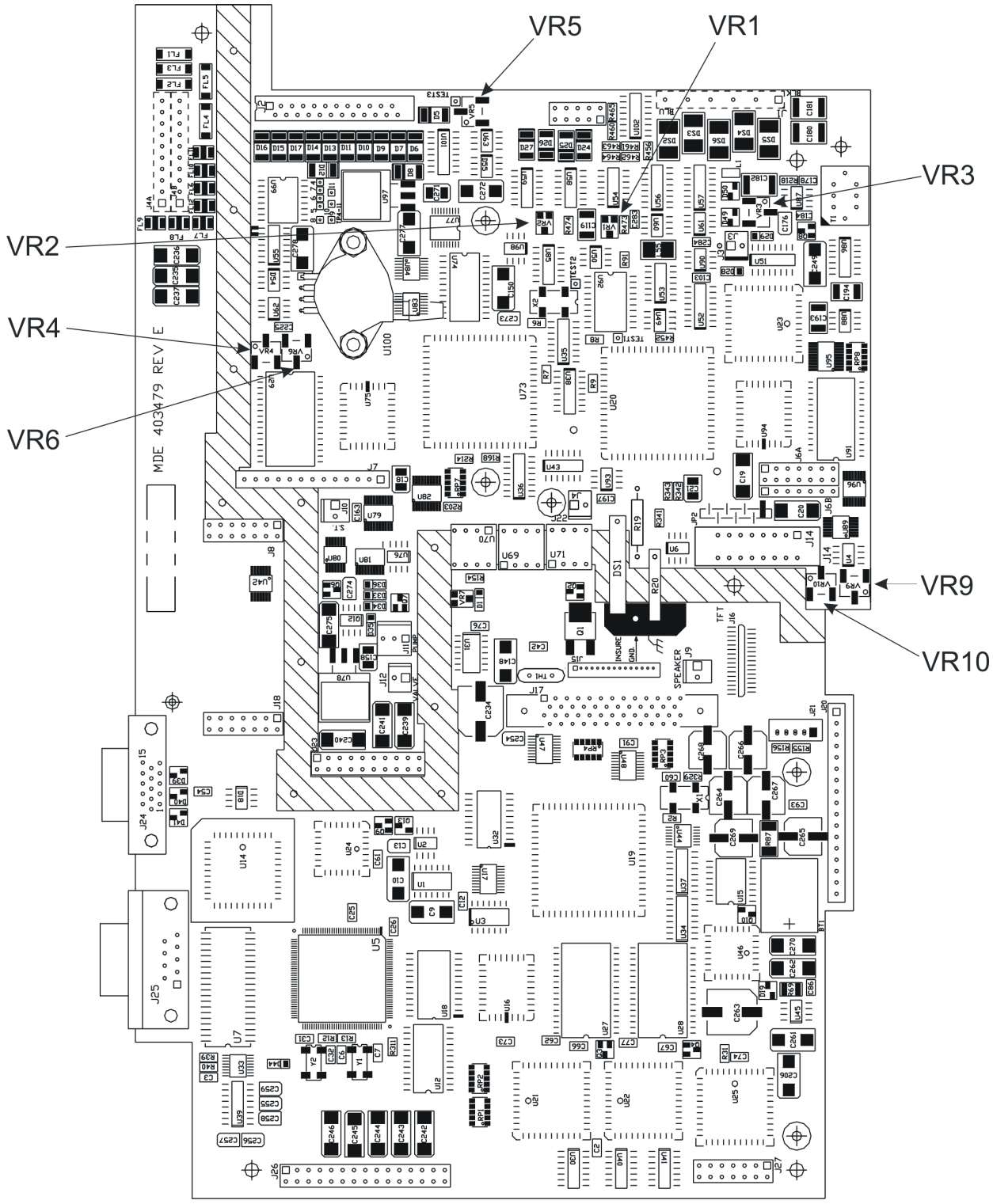


Figure 5-3. Escort M10 CPU Board with Adjustment Locations

Table 5-1. CPU Board Test Points

Test Points	
TP1	Negative five volts (-5VANL) **<4A, page 9>**
TP2	Positive five volts (+5VANL) **<4A, page 9>**
TP3	Analog ground **<4A, page 7>**
TP4	NIBP HI signal **<1B, page 8>**
TP5	5 minute timeout **<1A, page 8>**
TP6	Digital ground **<2A, page 8>**
TP7	Overpressure detect **<2A, page 8>**
TP8	ISO 307K signal **<3C, page 7>**
TP9	ECG vector1 signal, 3 lead **<1D, page 10>**
TP10	ECG vector2 signal, 5 lead **<1C, page 10>**
TP11	Respiration signal **<1D, page 11>**

Table 5-2. CPU Board Adjustments

Adjustments	
VR1	Common mode rejection adjustment, 3 lead ECG **<3D, page 10>**
VR2	Common mode rejection adjustment, 5 lead ECG **<3C, page 10>**
VR3	Respiration zero adjustment **<2C, page 11>**
VR4	NIBP gain adjustment **<3B, page 8>**
VR5	IBP gain adjustment **<3D, page 8>**
VR6	NIBP offset adjustment **<1B, page 8>**
VR7	Unused
VR8	Unused
VR9	SPO2 negative voltage adjustment **<4B, page 11>**
VR10	SPO2 positive voltage adjustment **<4A, page 11>**

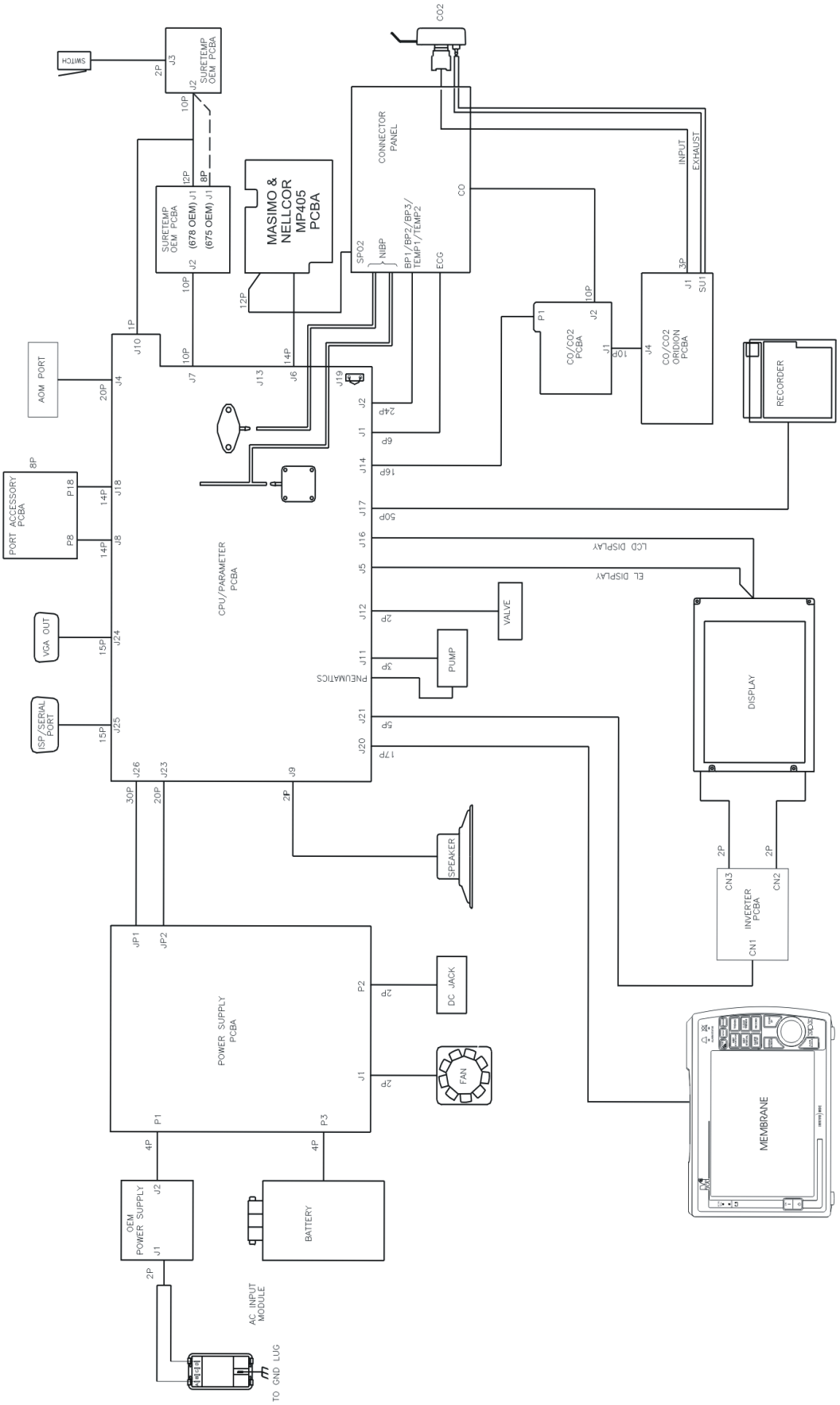


Figure 5-4. Escort M10 System Interconnect Diagram

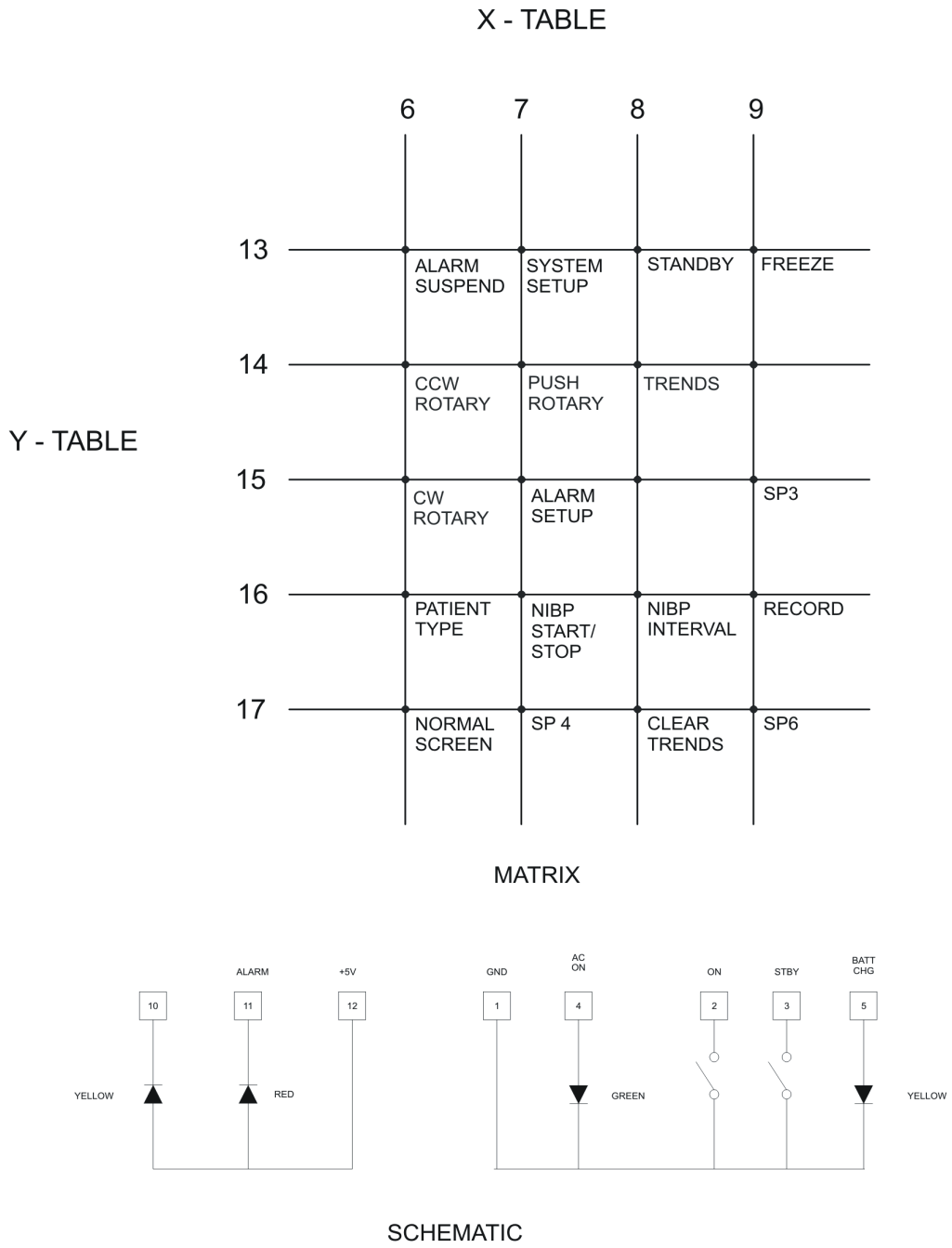


Figure 5-5. Escort M10 Membrane Matrix/Schematic

SECTION 6
PARAMETERS

6.0 PARAMETERS.

6.1 Overview. The Escort M10 can monitor up to eleven (11) parameters simultaneously. These include ECG, Respiration, SPO2 (Nellcor or Masimo), NIBP, IBP (3 max), YSI Temp (2 max), SureTemp (Welch Allyn), Cardiac Output (CO), and ETCO2 (Oridion). ***NOTE:*** *Some parameters are not available in all models*. ECG and NIBP have individual digital sections on the CPU board. All other parameters either use these CPU's or communicate directly to main CPU. All parameter communications are serial. The ECG CPU controls ECG, Respiration, and SPO2. The NIBP CPU controls NIBP, IBP, and Temperature (YSI and SureTemp). CO and CO2 communicate to the main CPU board when the applicable board is attached.

6.1.1 ECG. The monitor provides clinical viewing of the conduction of electrical impulses through various parts of the heart (ECG). These ECG signals are developed, converted to digital format, sent to the ECG processor, then sent to the main CPU processor. All ECG functions are controlled on the CPU board. The ECG processor communicates via serial communications with the CPU processor and controls ECG, Respiration, and SPO2 functions. ECG functions are: Lead Select, common mode rejection, Pacer Pulse Detect, Lead Fail (Check Leads), signal amplification, and ground lead switching.

Refer to Table 5-2 and Figure 5-3 located in Section 5 for adjusting the common mode rejection. An indication for this adjustment is a noisy ECG waveform.

6.1.2 Respiration. Respiration is derived from impedance pneumography using lead I (LA – RA). All Respiration functions are controlled on the CPU board. Respiration is enabled through the ECG software and processor. Respiration functions are: Lead Fail, cardiovascular artifact, apnea detect, and respiration calculations.

6.1.3 Pulse Oximetry (SPO2). SPO2 monitoring is available with a Nellcor or Masimo module. Either module connects to the main CPU board at J6 and J13. The ECG processor communicates to the SPO2 board via serial communications. SPO2 is standard with the option to choose Nellcor (OPT 30-SENEL) technology or Masimo (OPT 30-SEM) technology. There are three (3) modes to monitoring with SPO2; normal, fast, and slow. A pulse rate will not be displayed when using the slow mode.

6.1.4 Non-Invasive Blood Pressure (NIBP). NIBP is a standard option on the monitor and uses dual lumen cuffs and hoses. The oscillometric technique is used in determining NIBP. A proprietary algorithm has been developed by MDE to determine the blood pressure. All NIBP functions take place on the CPU board. NIBP digital functions are controlled by NIBP software and processor. A pressure transducer located on the CPU board has an output of 50 uV/mmHg. This output is amplified and split into a HI and LO channel. The HI channel is used for calculating Systolic, Diastolic, and Mean pressures. The LO channel is used to determine actual cuff pressure. NIBP calibrations can be achieved with adjustments VR4 (NIBP gain) and VR6 (NIBP offset).

The pump (12 VDC) and valve used for the NIBP parameter are located on the rear housing assembly. Please refer to the label "PUMP REPLACEMENT INSTRUCTIONS" located on the pump housing when servicing the pump and valve. The pump and valve are controlled with latch drivers located on the CPU board.

The monitor incorporates multiple safety aspects with the NIBP parameter. The first line of safety starts within the software code. The second line of safety is within the control electronics. A five minute sense circuit determines if any significant pressure persists after five minutes. Also, a comparator circuit is used to detect overpressure between 255 mmHg and 280 mmHg in the Adult mode. In the Neonatal mode, electronic overpressure is between 155 mmHg and 170 mmHg. A mechanical relief valve is mounted on the CPU board to detect pressures above ~315 mmHg. This will enable the valve and bleed any pressure in the pneumatics assembly. A "CHECK CUFF" message will appear on the front display if any safety circuits have been enabled.

6.1.5 Invasive Blood Pressure (IBP) (OPT31-SE, OPT33-SE, and OPT48-SE). The monitor can provide the monitoring capability of up to three invasive blood pressures. IBP is compatible with all 5 uV/V/mmHg type external pressure transducers. All IBP functions are computed on the CPU board via the NIBP microprocessor circuit. Calibration of the IBP circuit can be performed using VR5 (IBP gain). Zeroing of the IBP is performed with software when the operator selects the "ZERO" option in the IBP Menu.

6.1.6 Temperature (YSI). Temperature monitoring on the Escort M10 supports both YSI-400 and YSI-700 type temperature probes. Two YSI (Yellow Springs Instruments) temperatures may be present with Option OPT50-SE. The ring voltage determines which type of probe is connected. A ring voltage of 20 mV or less indicates that a YSI-400 type probe is connected. A ring voltage higher than 20 mV indicates a YSI-700 type probe. Temperature functions are controlled on the CPU board via the NIBP microprocessor circuit.

6.1.7 SureTemp (Option--OPT54-SE). SureTemp is achieved through a proprietary algorithm which calculates (predicts) a temperature reading before reaching a thermal steady state. There are two modes for the SureTemp parameter; normal (predictive) and monitor modes. Temperatures may be taken in the oral, rectal, and axillary locations. The time it takes to predict an Oral temperature is 4 seconds. Rectal temperatures take about 15 seconds for a final reading. Oral temperatures are taken utilizing a patient's sublingual pocket.

A SureTemp board Welch Allyn is connected to the CPU board at J7. The SureTemp interface board routes the thermistor, probe switch, and connector signals to the SureTemp board.

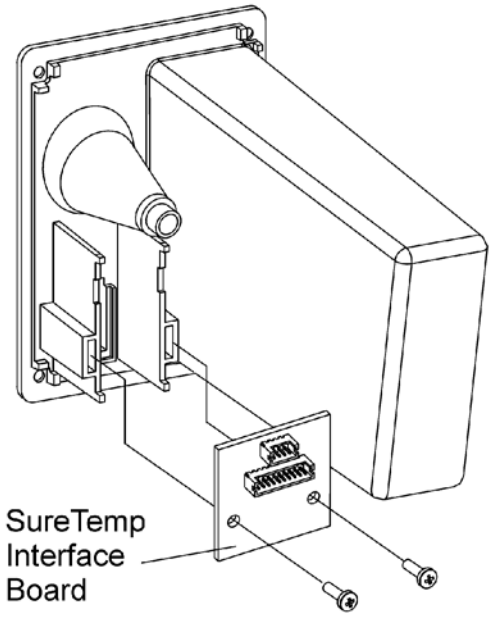


Figure 6-1. SureTemp Housing Assembly

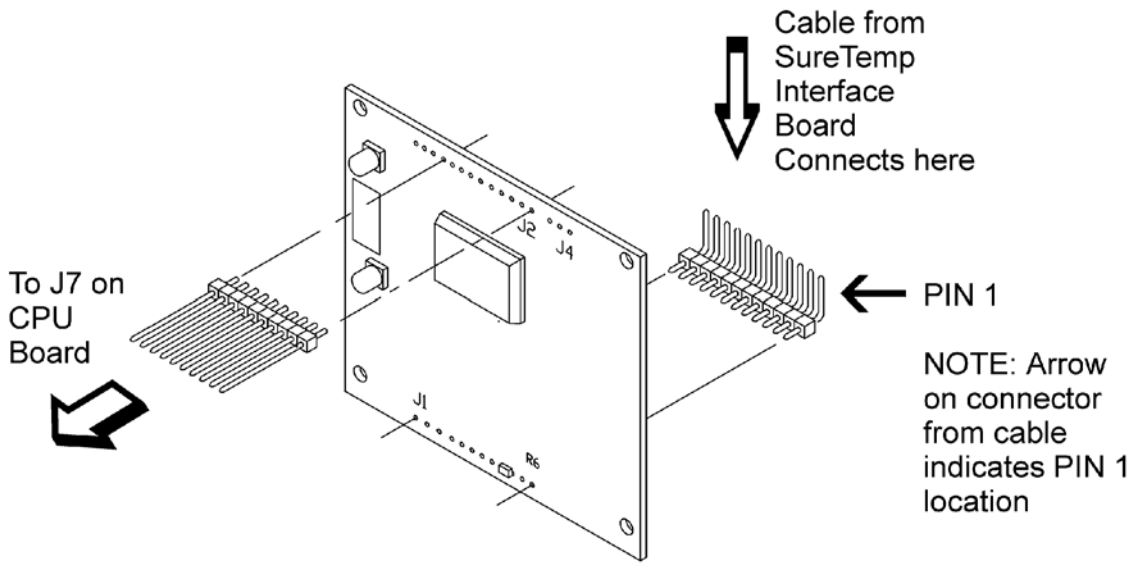


Figure 6-2. PCBA--SureTemp (678 OEM)

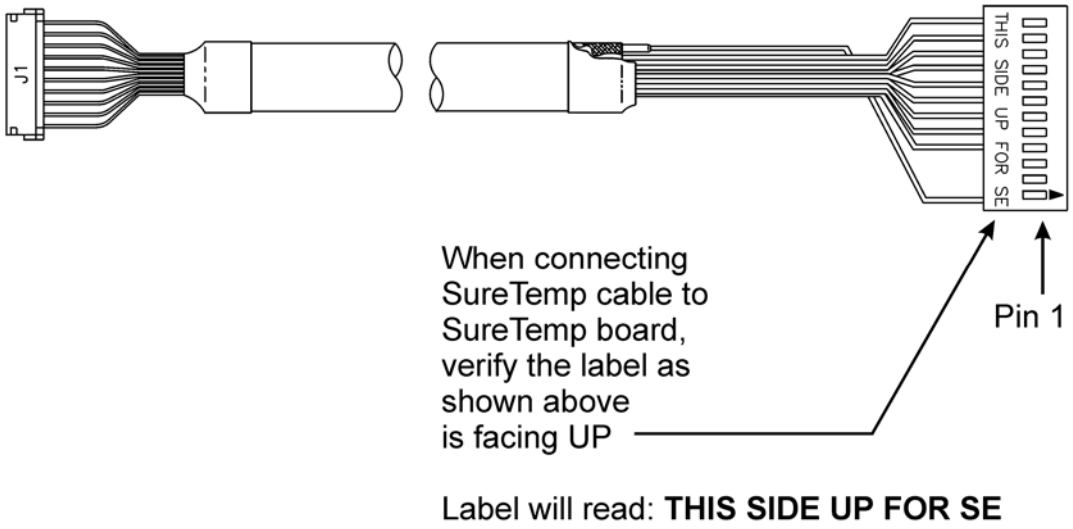


Figure 6-3. SureTemp Temperature Cable Orientation

WARNING

The SureTemp temperature probe (Option OPT54-SE) may overheat if the SureTemp temperature cable is not installed correctly.

6.1.8 CO2 (Option--OPT36-SE). The monitor uses infrared absorption spectroscopy to measure CO2. ETCO2 monitoring is available with a CO2 Oridion board and a CO2 or CO/CO2 board. Refer to Figure 6-5. The CO2 Oridion board auto detects the CO2 Microstream Filterline connection and calculates PCO2 values. A spring-loaded cover is used to prevent any debris from entering the CO2 pneumatics from the connector assembly. Calibration of the CO2 Oridion board can be performed using the Microstream ETCO2 Calibration Kit. The calibration procedure needs to be performed every 4,000 hours or 1 year. The number of hours is displayed on the STAT INFO SW Test page. After 65,535 hours, the counter will be reset to 0 hours. The CO2 or CO/CO2 board provides the digital-processing interface between the main CPU and the CO2 Oridion board. The CO2 or CO/CO2 board software revision will be listed on the TEST page and the CO2 Oridion software revision will be listed on the STAT INFO SW test page. The CO2 or CO/CO2 board connects to J14 on the CPU board.

NOTE

Contact InvivoMDE Technical Support for obtaining the Microstream ETCO2 Calibration Kit.

WARNING

DO NOT attempt to open the Oridion Module. It is not serviceable by the user and hazardous chemicals may be present if opened. If the module needs service or repair, the module MUST be sent to the InvivoMDE facility.

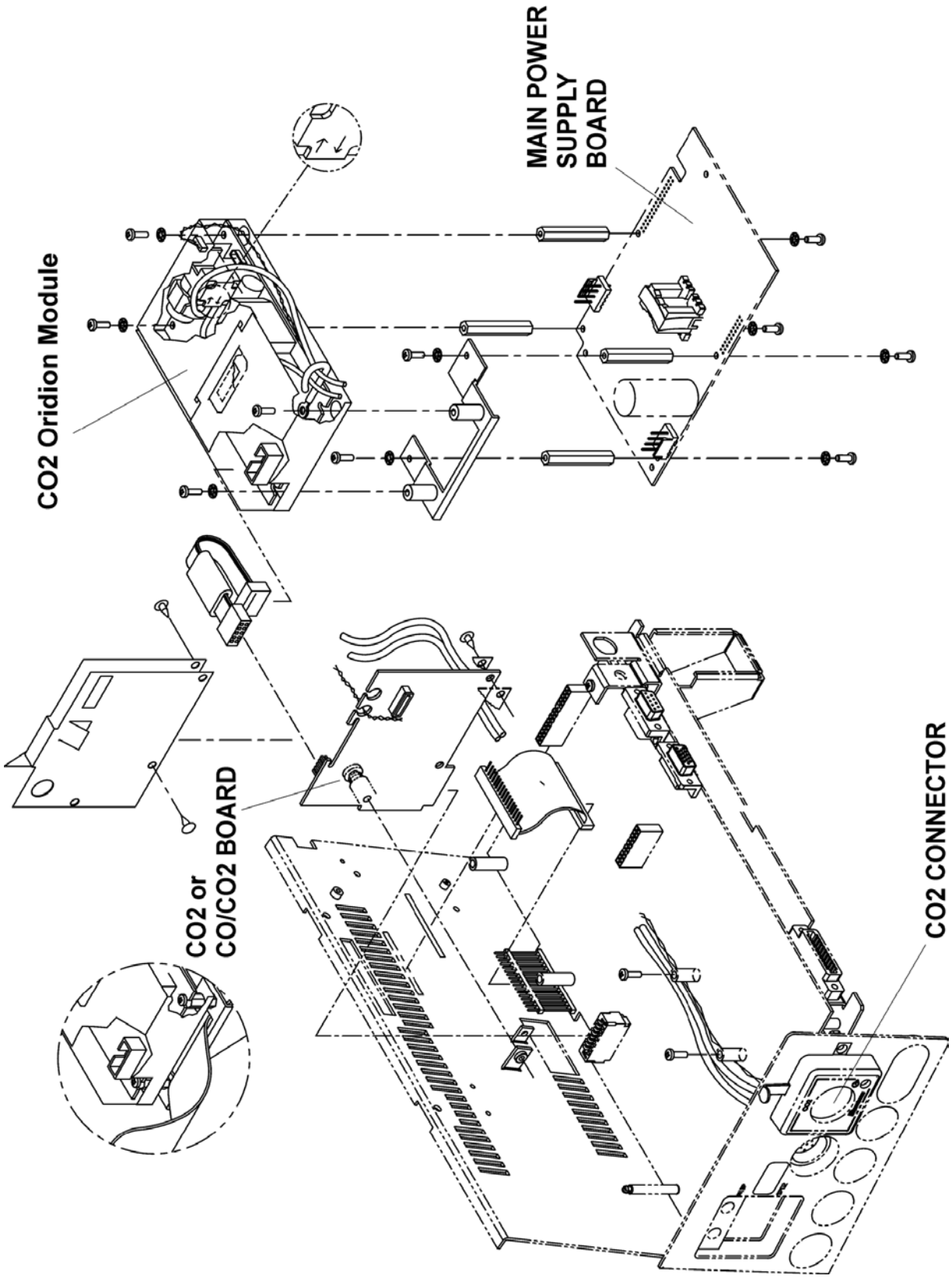


Figure 6-4. CO2 Option Assembly

6.1.9 Cardiac Output (Option--OPT72-SE). The monitor uses the thermodilution method for measuring cardiac output and right ejection fraction (CO/REF). All CO functions are calculated and processed on the CO or CO/CO2 board. The CO or CO/CO2 board communicates to the main CPU via serial communications. Refer to Figure 6-6 for the location of the board. The CO2 or CO/CO2 board connects to J14 on the CPU board. The functions of the CO or CO/CO2 board are: Thermistor temperature amplification, Bath temperature amplification, Flow through or Injectate amplification, and information processing.

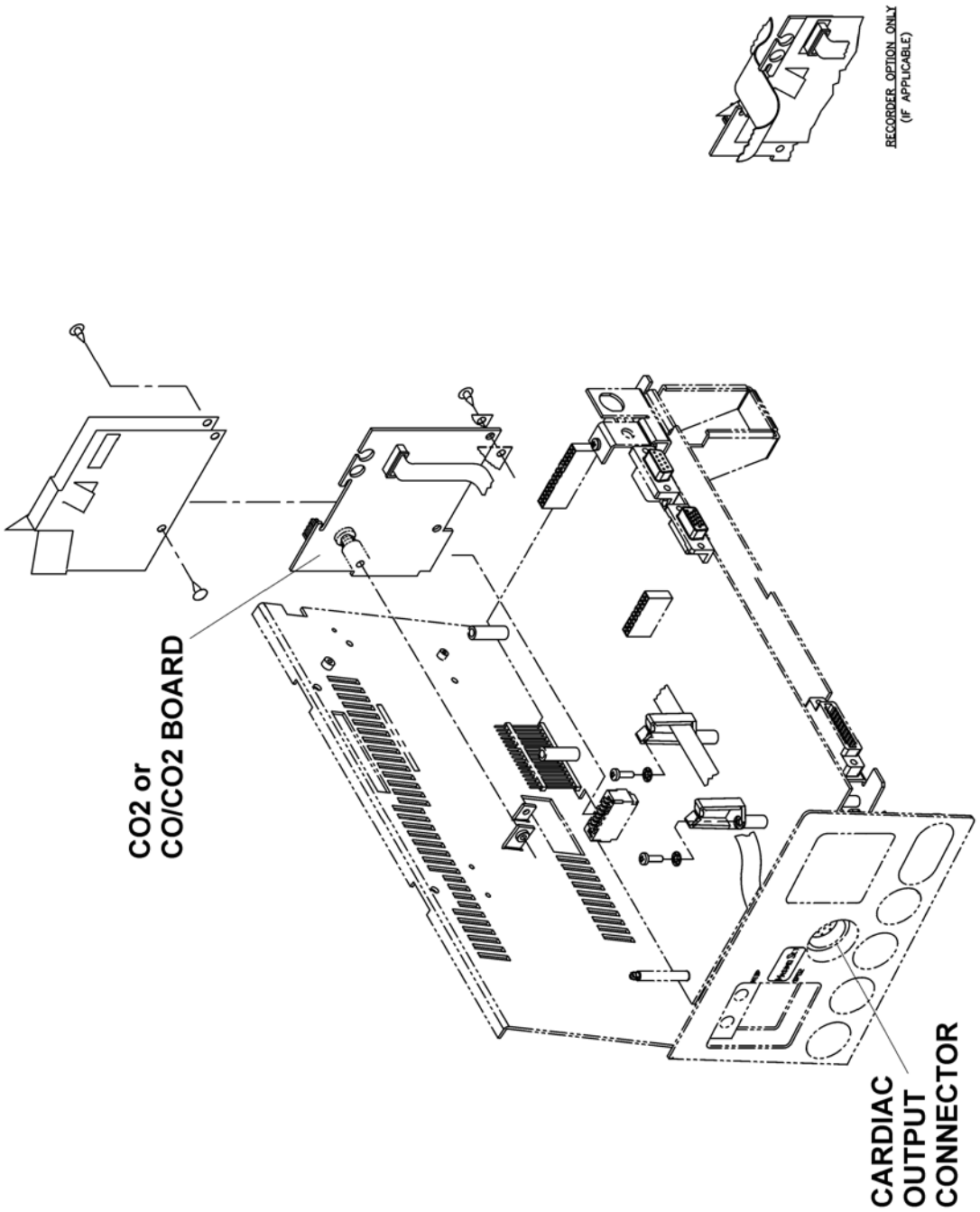


Figure 6-5. Cardiac Output Option Assembly

SECTION 7
NON-PARAMETER OPTIONS

7.0 NON-PARAMETER OPTIONS.

7.1 Recorder (Option--OPT03-SE). Escort M10 monitors may be equipped with an optional thermal recorder, see Figure 7-1. All alphanumeric and waveform data displayed on the monitor's screen may be sent to the recorder for printing.

If the recorder option is not included, a non-recorder blank cover is installed to fill the recorder cavity in the monitor. The non-recorder blank cover is shown in Figure 7-2.

Monitors that do not include the Thermal Recorder option may be easily upgraded by replacing the non-recorder configuration with a Thermal Recorder as shown in Figure 7-3.

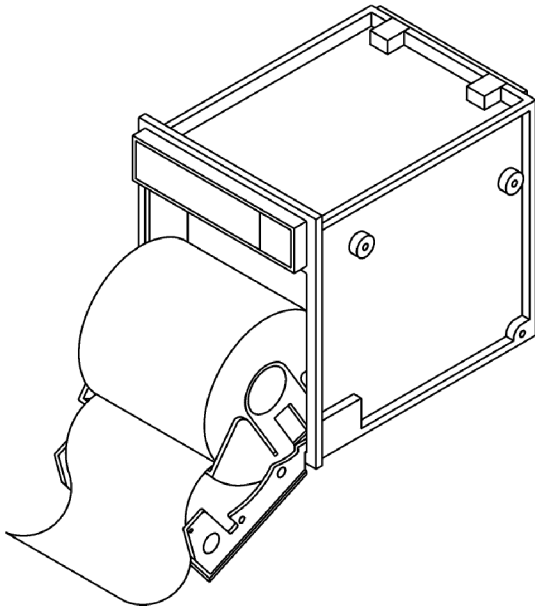


Figure 7-1. Thermal Recorder Option

CAUTION

The Recorder is NOT a hot-pluggable component. Ensure that all power is removed form the monitor when connecting/disconnecting the recorder cable.

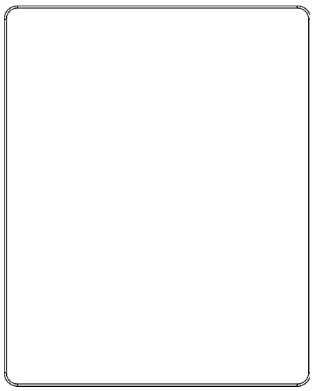


Figure 7-2. Non-Recorder Blank Cover

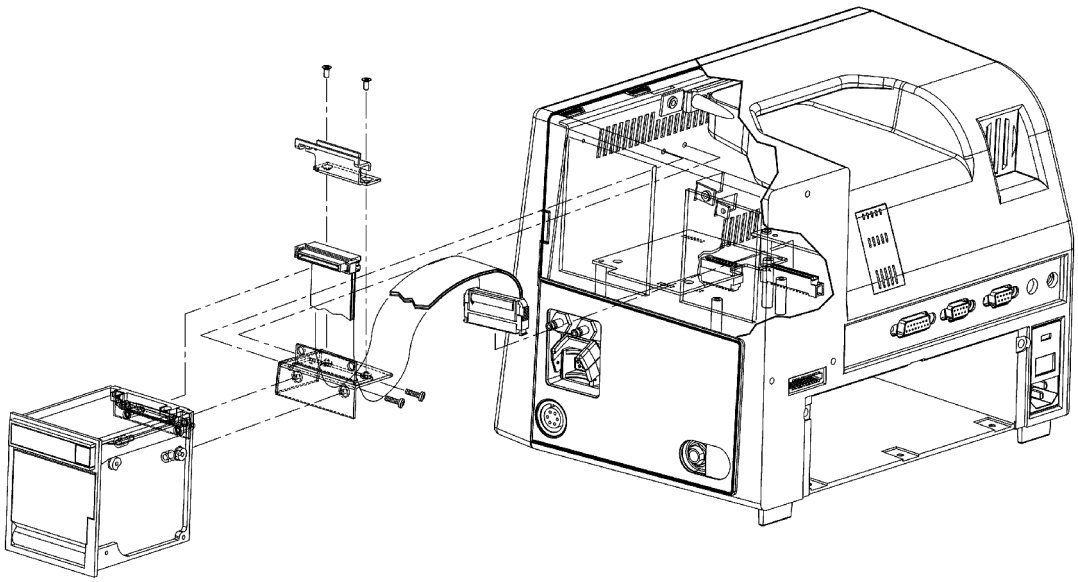


Figure 7-3. Thermal Recorder Option Upgrade

7.2 VGA Output (Option--OPT53-SE). The optional **VGA OUTPUT** port on the rear panel of the monitor allows for an external VGA monitor to be connected. The same information that is displayed on the monitor will display on the external VGA monitor. Refer to the **"Rear Panel"** paragraph in **Section 2** for the location of this connector port (Figure 2-4). The connector port will be labeled, item number eight (8) in the illustration. You will need a Power Isolation Transformer connected to the VGA monitor.

7.3 High Level Outputs (Option--OPT61-SE). The monitor allows programming and control of three output ports (PORT1, PORT2, and PORT3). These signals originate from the Port Accessory board, which connects to the CPU board at J8 and J18, and are routed to the Auxiliary Output Connector on the rear panel. Refer to the **"Rear Panel"** paragraph in **Section 2** for the location of this connector port (Figure 2-4). The connector port will be labeled, item number seven (7) in the illustration.

Each port may deliver any of three signal outputs. The signal can be a waveform output, an alarm-triggered output, or a record-triggered output. The signals can be sent to Nurse Call Panels, Remote Slave monitors, or various recording devices. Interfacing with many of these devices may require the use of the High Level Interface Module (HLIM), P/N E2900-33. Contact Invivo)MDE Technical Support for ordering information.

The monitor may also be connected to an external defibrillator. When [RING], the external QRS sync signal, goes high, it turns on Q1, which will pull the defibrillator flag signal, [DFIBFLG2], low. The [QRSOUT] signal, if present, can be monitored at Pin-11. The analog ground is on Pin-15, while the digital ground is on Pin-14. The [SLEEVE] voltage level is tied to analog ground through R9. The [TIP], which is the ECG high level output signal, is connected to [HI_LEVEL] through R8. See Table 7-1 for pin designations.

Each port can be defined by accessing the CONFIGURATION SETUP Menu using the monitor's imbedded menu system. Scaling factors, DC offsets, and coupling for each of the parameters are listed in Table 7-2. In addition, Table 7-3 outlines the types of signal outputs for which each port can be programmed.

NOTE

The outputs will be clipped if the displayed waveform is clipped.

7.3.1 Nurse Call System and Alarm Panel. The monitor provides a single-pole/double-throw relay that can be used to interface to a nurse call system or alarm panel. When the monitor is not in alarm, the relay pole, ALARM_NO (Normally Open) will be in the open position and ALARM_NC (Normally Closed) will be in the closed position.

If an alarm is activated, the relay contacts toggle at different rates. For high limit alarms, it is on for 300 milliseconds and off for 300 milliseconds. For low limit alarms, it is on for 600 milliseconds and off for 600 milliseconds. By applying a voltage to either ALARM_NC or ALARM_NO, an alarm panel or nurse call system can be connected to ALARM_O. The maximum voltage that can be applied to ALARM_NC or ALARM_NO is 12 VDC, and the maximum current should be limited to 0.5A.

Table 7-1. Auxiliary Output Connector--Pin Designations

Signal Name	Aux. Output Conn.	Signal Name	Aux. Output Conn.
ALRM_0	1	RING	8
PORT1	2	+5V	9 (limited to 0.5A)
ALRM_NC	3	TIP/HI-LEVEL	10
PORT2	4	QRSOUT	11
ALRM_NO	5	DIGITAL GND	14
PORT3	6	ANALOG GND	15

Table 7-2. Parameter Scaling Factors, DC Offsets, and Coupling

Parameter	Scale	DC Offset	Coupling
ECG	1V= 1 mV	2.5V	DC
BP (PULSE)	1V= 100 mmHg	1.6V	DC
BP (SCALE)	1V= 100 mmHg	0V	DC
RESP	1V= 1 ohm	2.5V	DC
SPO2	4V= 100%	0V	DC
CO2	1V= 10.01 mmHg	0.2V	DC
TEMP	1V= 10* C	0V	DC
HR	1V= 51 BPM	0V	DC

Table 7-3. Programmable Outputs

Output	Parameter	Definition
WF1	AUTO	Any trace displayed in waveform area 1 is output.
WF2	AUTO	Any trace displayed in waveform area 2 is output.

Table 7-3. Programmable Outputs (Continued)

Output	Parameter	Definition
WF3	AUTO	Any trace displayed in waveform area 3 is output.
WF4	AUTO	Any trace displayed in waveform area 4 is output.
WF	ECG	The ECG waveform is output.
	BP1	The BP1 waveform is output.
	BP2	The BP2 waveform is output.
	BP3	The BP3 waveform is output.
	CO2	The CO2 waveform is output.
	PLETH	The SPO2 pleth waveform is output.
	RESP	The Respiration waveform is output.
	HR	The Heart Rate numeric is output.
	SPO2	The SPO2 percentage numeric is output.
	T1	The TEMP1 Temperature numeric is output.
	T2	The TEMP1 Temperature numeric is output.
ALARM	ANY	Enables on any alarm.
	FLASH	Enables alternating ON/OFF (flashing) on any alarm.
	ECG	Enables on any ECG alarm.
	BP1	Enables on any BP1 alarm.
	BP2	Enables on any BP2 alarm.
	BP3	Enables on any BP3 alarm.
	CO2	Enables on any CO2 alarm.
	NIBP	Enables on any NIBP alarm.
	SPO2	Enables on any SPO2 alarm.
	RESP	Enables on any Respiration alarm.
	T1	Enables on any TEMP1 Temperature alarm.
	T2	Enables on any TEMP2 Temperature alarm.
KEY	REC	Enables when the RECORD key is pressed.

SECTION 8
MECHANICAL

8.0 MECHANICAL.

WARNING

High voltages may be present! Remove all power from the AC Mains, External DC Supplies, and remove batteries. Failure to do so may cause serious injury.

CAUTION

The **Escort M10 Vital Signs Monitor** contains Static Sensitive circuits. Proper handling procedures must be followed when touching any Printed Circuit Board (PCB) as static voltages usually present on clothing and personnel present great risk of damage to the circuits. **All Service Procedures *MUST* be performed by Properly Grounded Personnel at a Static-Free Work Station**.

8.1 Overview. This chapter provides the information necessary to disassemble the Escort M10 monitor.

8.2 Required Tools. The following tools are required to assemble/disassemble the monitor:

- 7/64 inch Hex Ball Driver
- Phillips Screwdriver(s)
- 1/4 inch Hex Driver
- Needle-nose Pliers (small)
- Standard Screwdriver(s)

8.3 Disassembly. Perform the following procedures to disassemble the monitor.

8.3.1 Bezel Removal. Perform the following procedures to remove the bezel:

a. Remove the three (3) screws under the front bezel.

b. Swing the bezel over the unit. ***Be careful not to torque or damage the membrane ribbon cable***.

c. Remove the four (4) hex screws around the display with the 7/64 inch hex ball driver tool.

d. Loosen the two (2) screws inside the recorder with a #1 Phillips screwdriver (open the recorder door and remove any paper).

e. Remove the recorder.

f. Slide the display w/ chassis forward approximately 3 inches.

g. Carefully remove the membrane cable from J20 on the CPU board (extended connector).

8.3.2 Display Removal. Perform the following procedures to remove the color display:

a. Complete steps a. through f. from the Bezel removal procedure.

b. Disconnect the display cables to the power inverter board from the left side of the unit.

c. Remove the four (4) screws from the front of the display.

d. Remove the video cable from the CPU board at J16.

e. Carefully remove the display and use safe static techniques.

f.

8.3.3 Recorder Removal. Perform the following procedures to remove the recorder:

a. Complete steps a. through e. and/or f. from the Bezel removal procedure.

b. Remove the latching cable from the rear of the recorder (on earlier version models).

8.3.4 Battery Removal. Perform the following procedures to remove the black type batter(ies)

a. Locate the battery compartment cover at the rear of the unit.

b. Remove the five (5) screws around the battery cover.

c. Remove battery assembly from battery compartment.

d. Disconnect battery cable from interconnect cable.

8.3.5 Main Chassis Removal. Perform the following procedures to remove the main chassis:

a. Complete steps a. through f. from the Bezel removal procedure.

b. Remove the recorder assembly per the recorder removal procedure.

c. Disconnect the NIBP tubing from CPU board.

d. Disconnect the NIBP pump cable from J11 on the CPU board.

e. Disconnect the NIBP valve cable from J12 on the CPU board.

f. Disconnect the fan cable from J1 on the power supply board.

g. *If equipped with the SureTemp Option, disconnect white wire from J10 on the CPU board and the multi-colored cable from J1 on the SureTemp board.*

h. Disconnect the battery cable connection J17 from under the chassis assembly.

i. Slowly slide the chassis forward.

8.3.6 Main Power Supply Removal. Perform the following procedures to remove the main power supply:

a. Remove the main chassis as per the main chassis procedure.

b. Locate the main power supply.

c. Disconnect the battery connection from P3 on the power supply board.

d. Disconnect the OEM power supply connection from P1 on the power supply board.

e. Disconnect the external DC connection from P2 on the power supply board.

f. Remove the three (3) securing screws.

g. Carefully place the ground wire to the side of the power supply. (for Rev A CPU Boards)

h. Carefully remove the power supply board from the standoffs.

CAUTION

Do not flex the power supply board.

8.3.7 OEM Power Supply Removal. Perform the following procedures to remove the OEM power supply:

a. Remove the main chassis as per the main chassis procedure.

b. Remove the AC power input connector from J1 on the OEM power supply board.

c. Remove the DC output connector from J2 on the OEM power supply board.

d. Remove the two nuts below the CPU board securing the OEM power supply board using a 1/4 inch hex nut driver.

e. Carefully remove the securing screw and mount for the OEM power supply board.

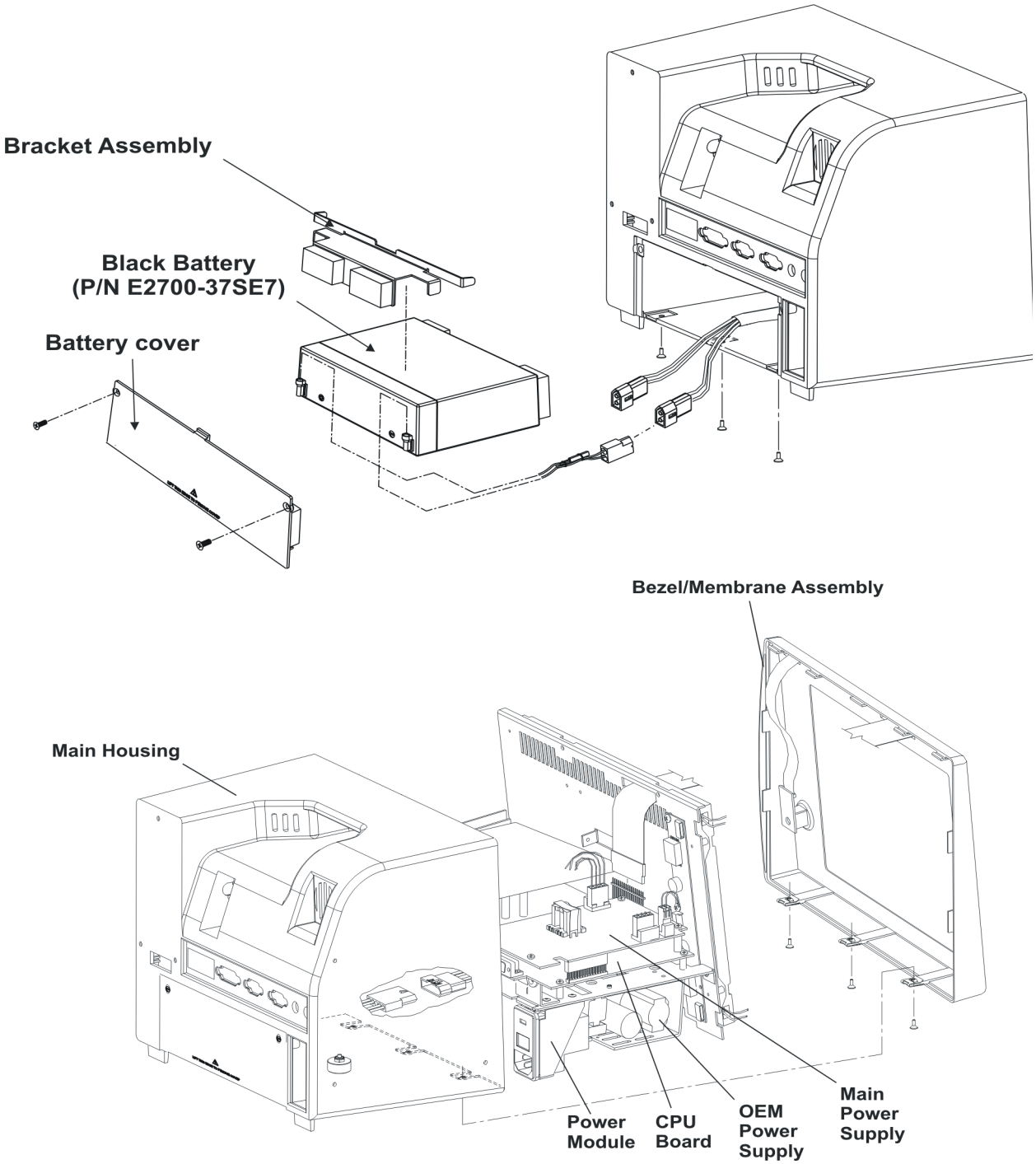


Figure 8-1. Escort M10 Monitor Assembly

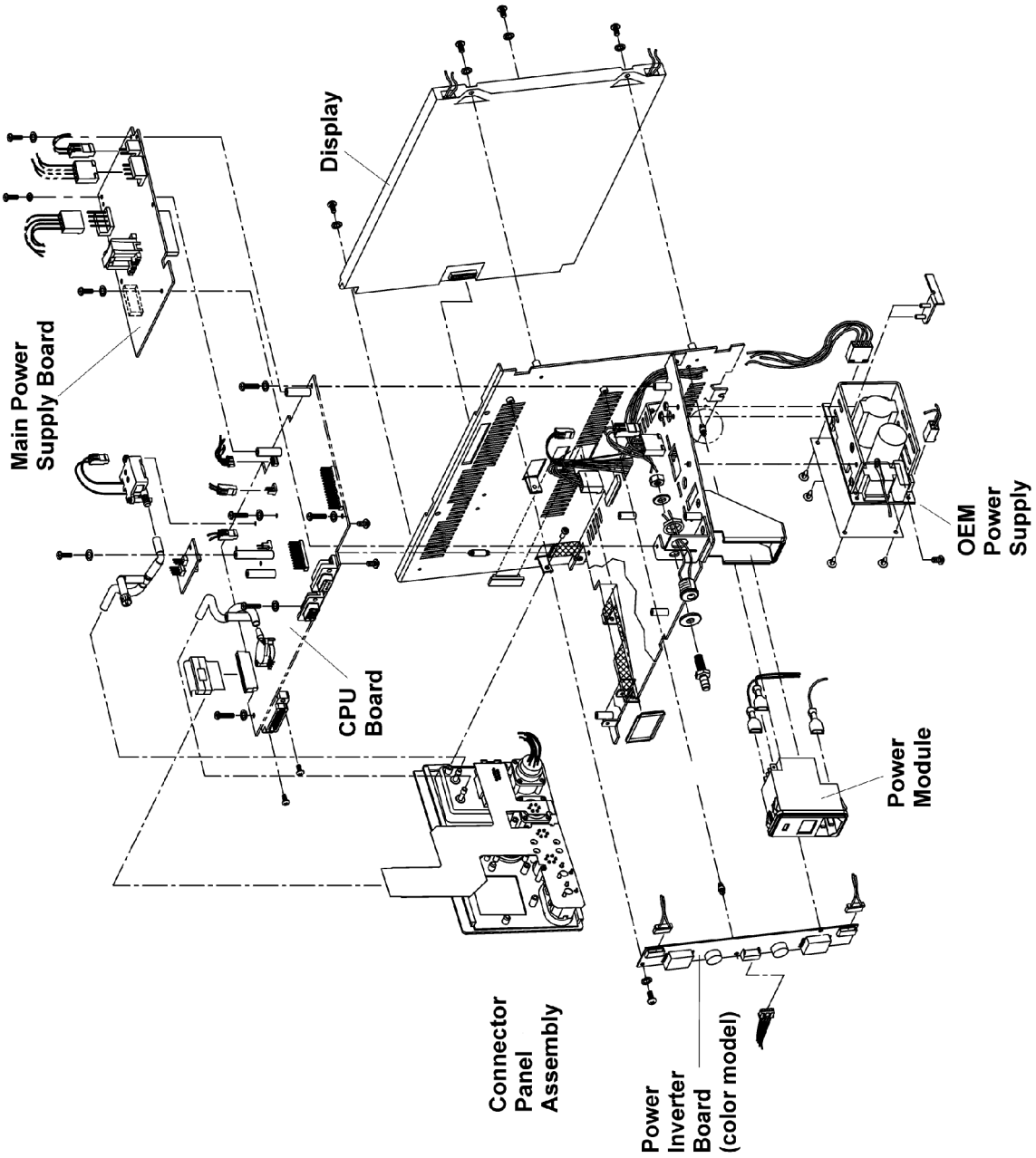


Figure 8-2. Escort M10 Chassis Assembly

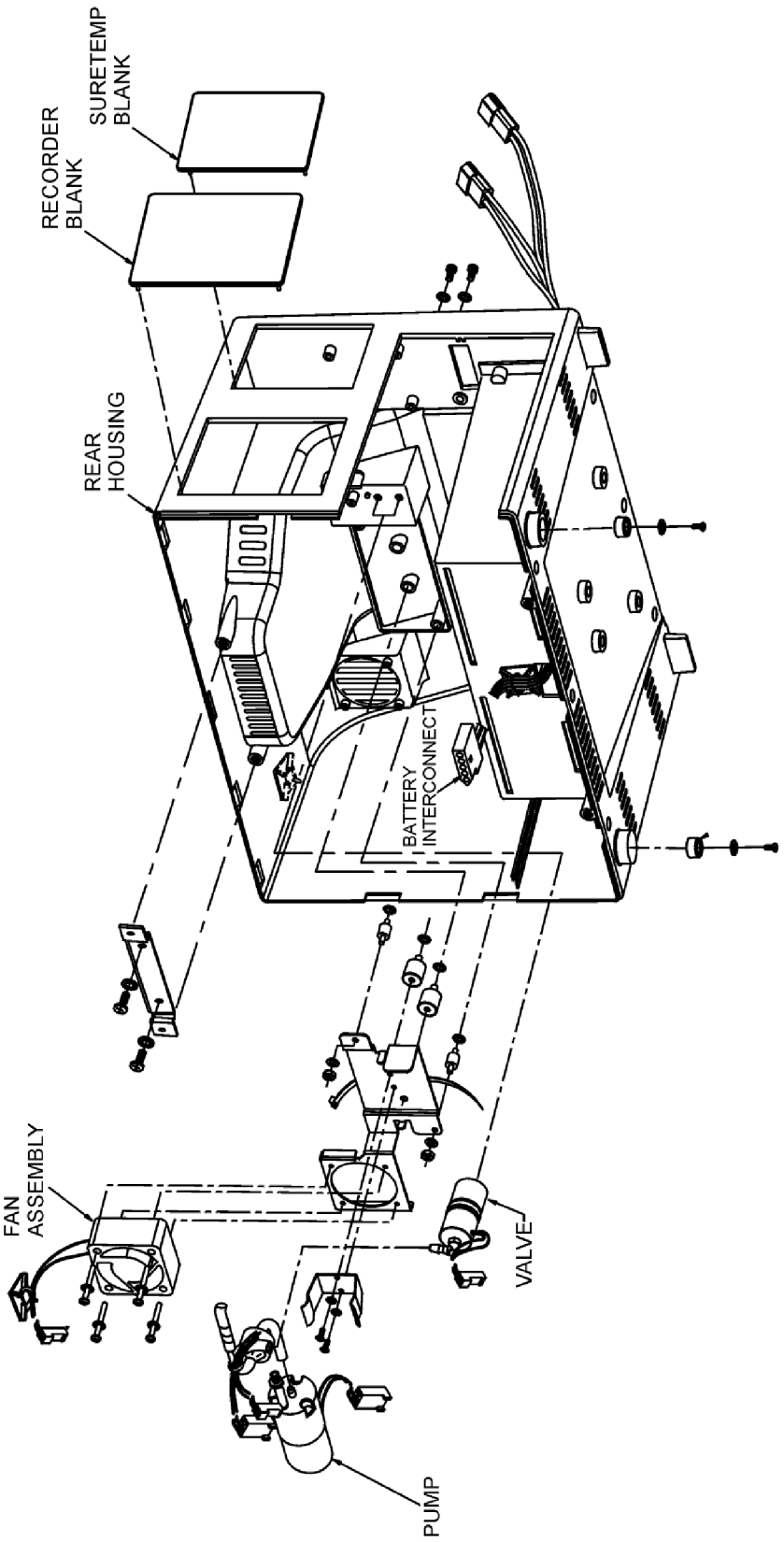


Figure 8-3. Escort M10 Rear Housing Assembly

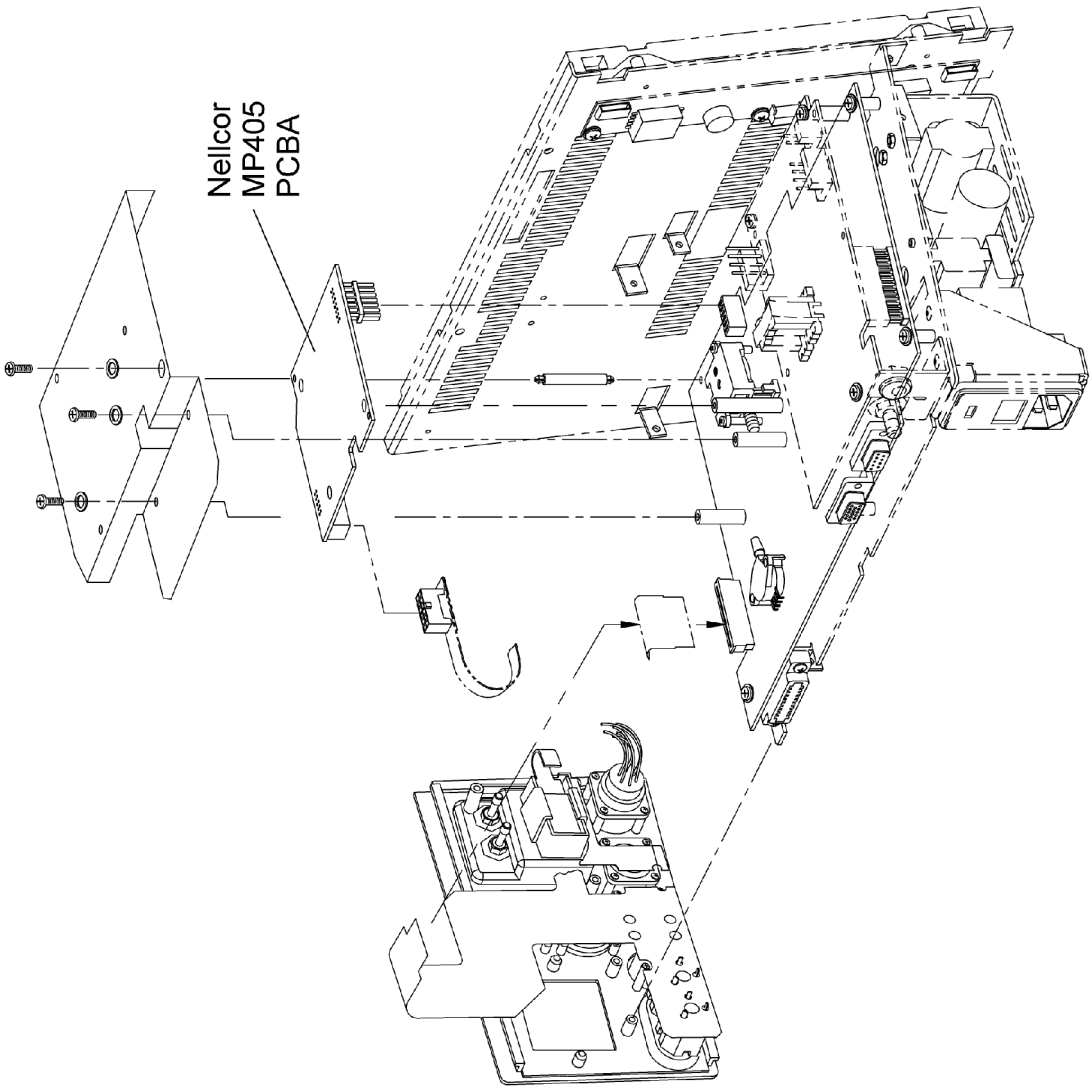


Figure 8-4. Nellcor MP405 SPO2 PCBA Assembly

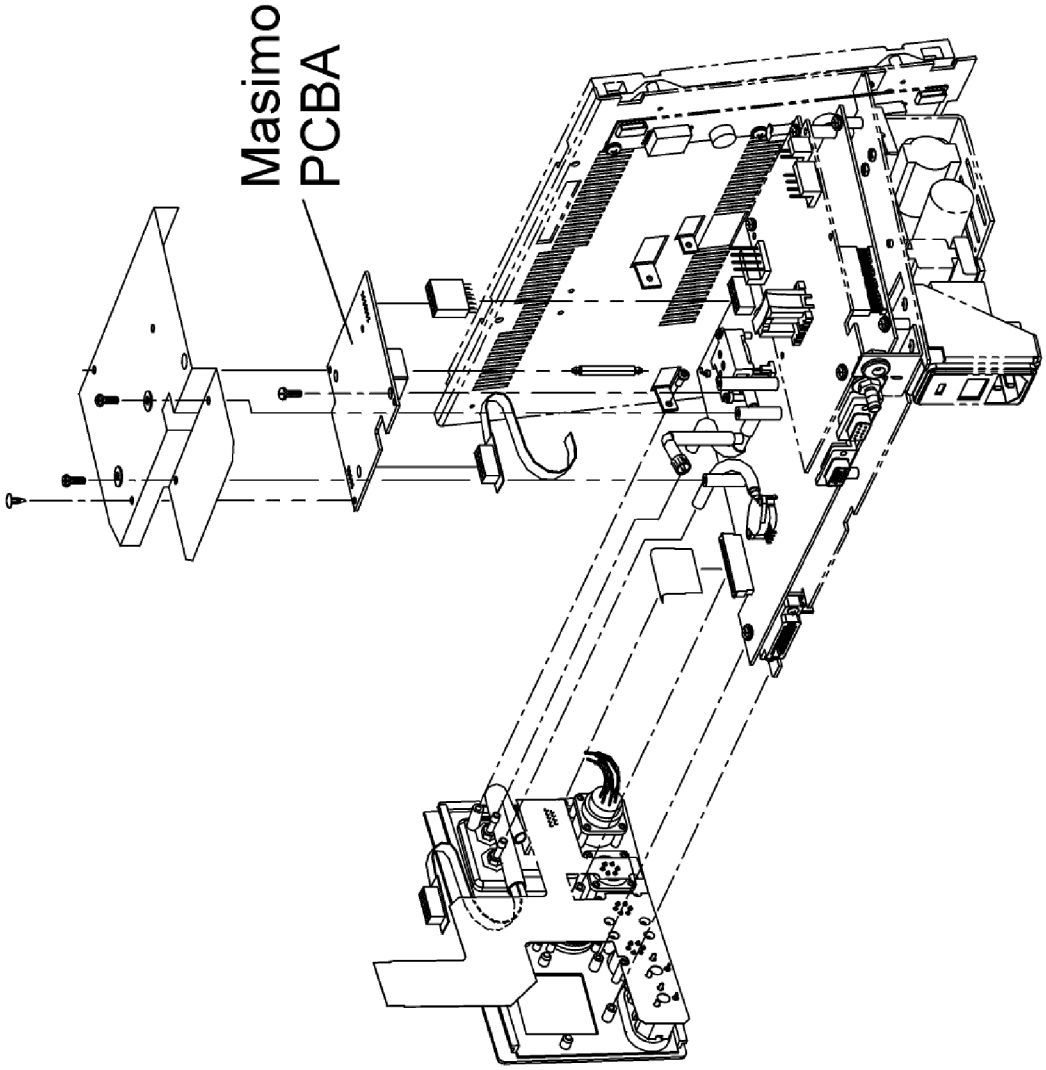


Figure 8-5. Masimo SPO2 PCBA Assembly

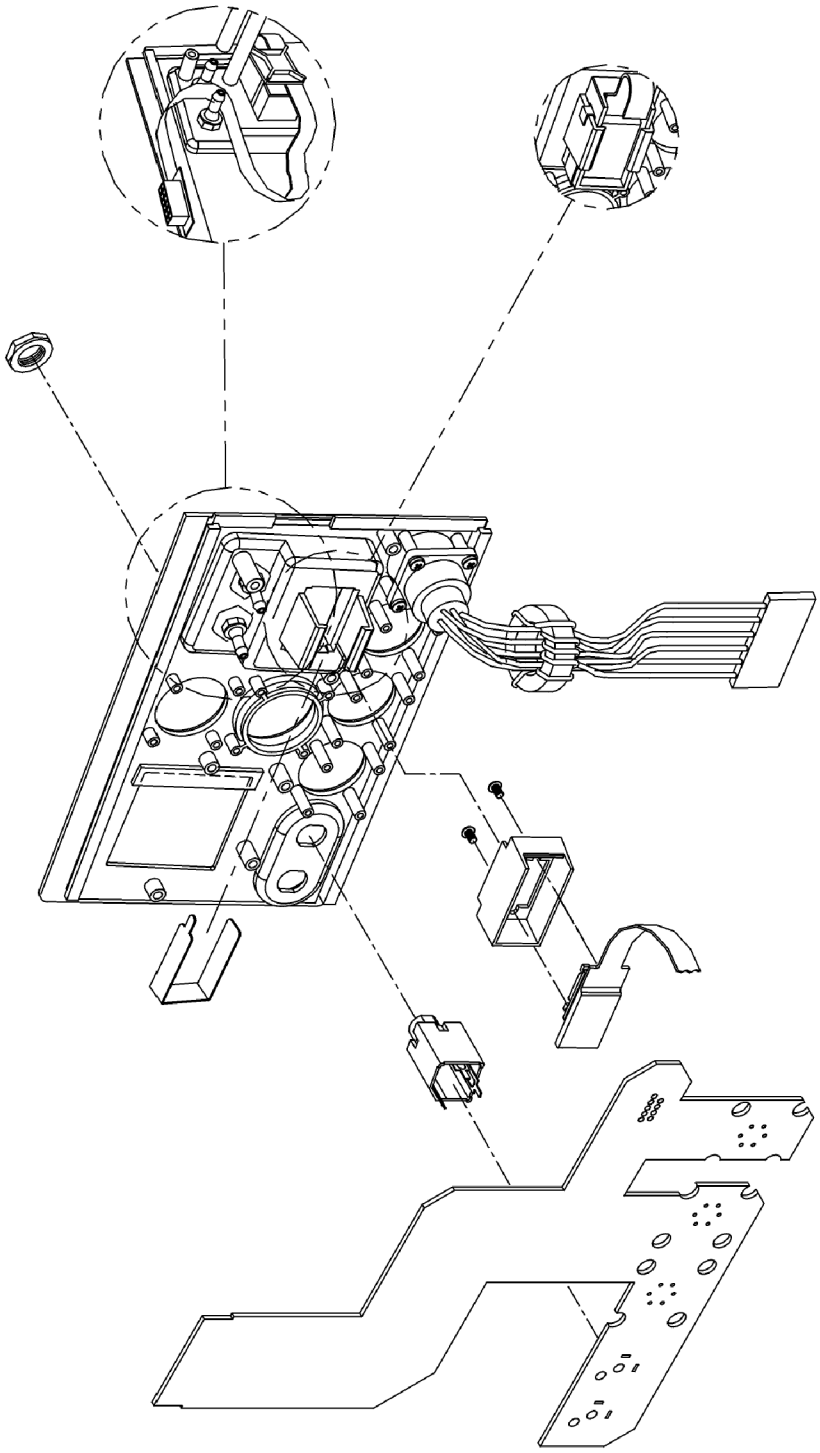


Figure 8-6. Connector Panel Assembly--Nellcor MP405

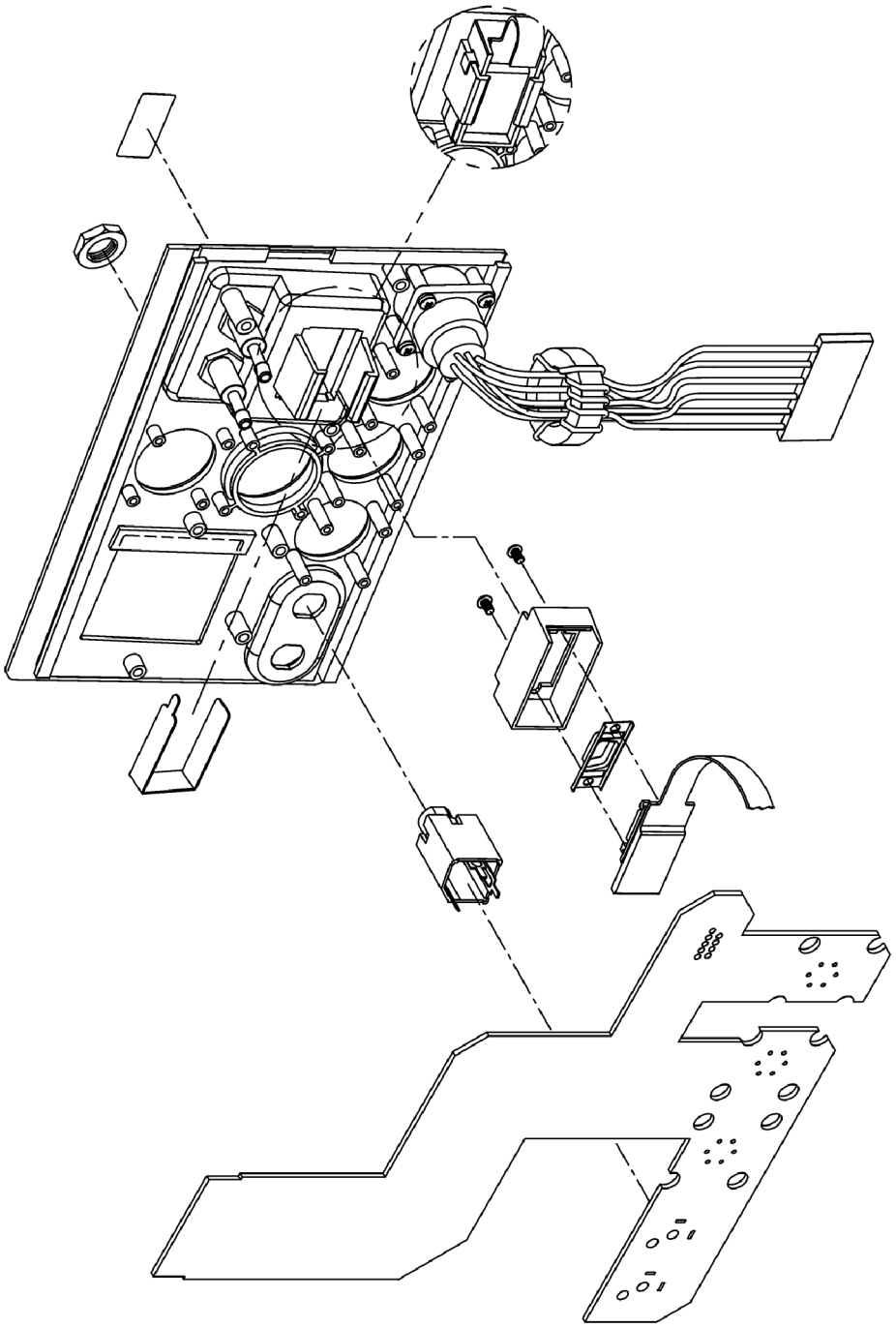


Figure 8-7. Connector Panel Assembly--Masimo

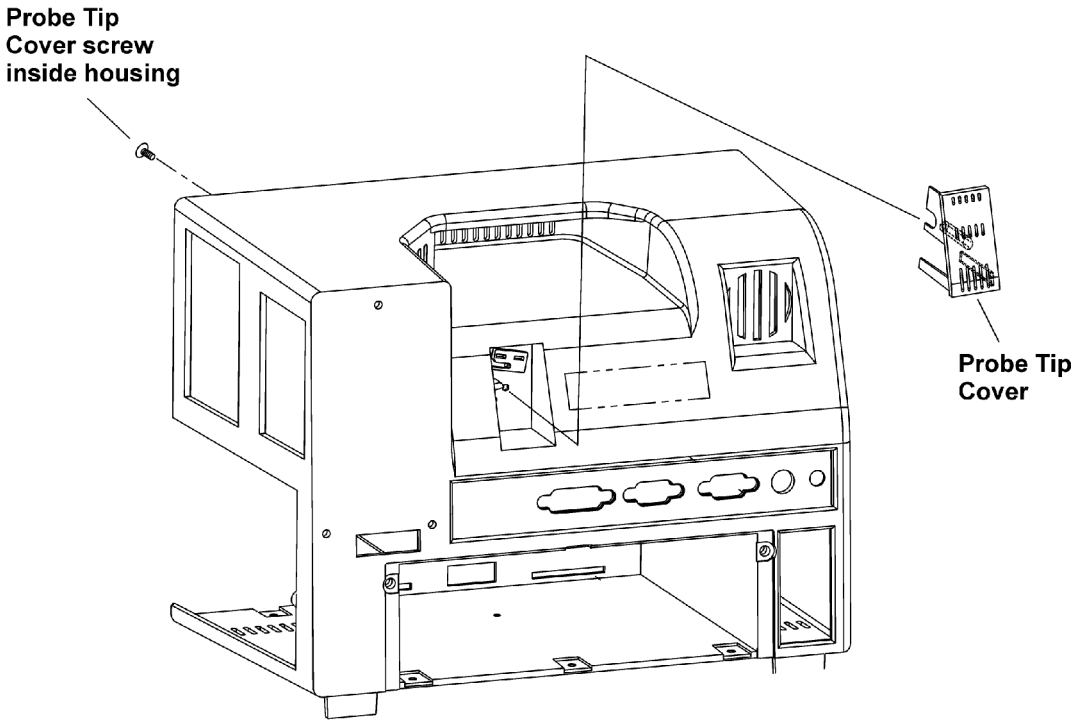


Figure 8-8. SureTemp Probe Tip Cover (if applicable)

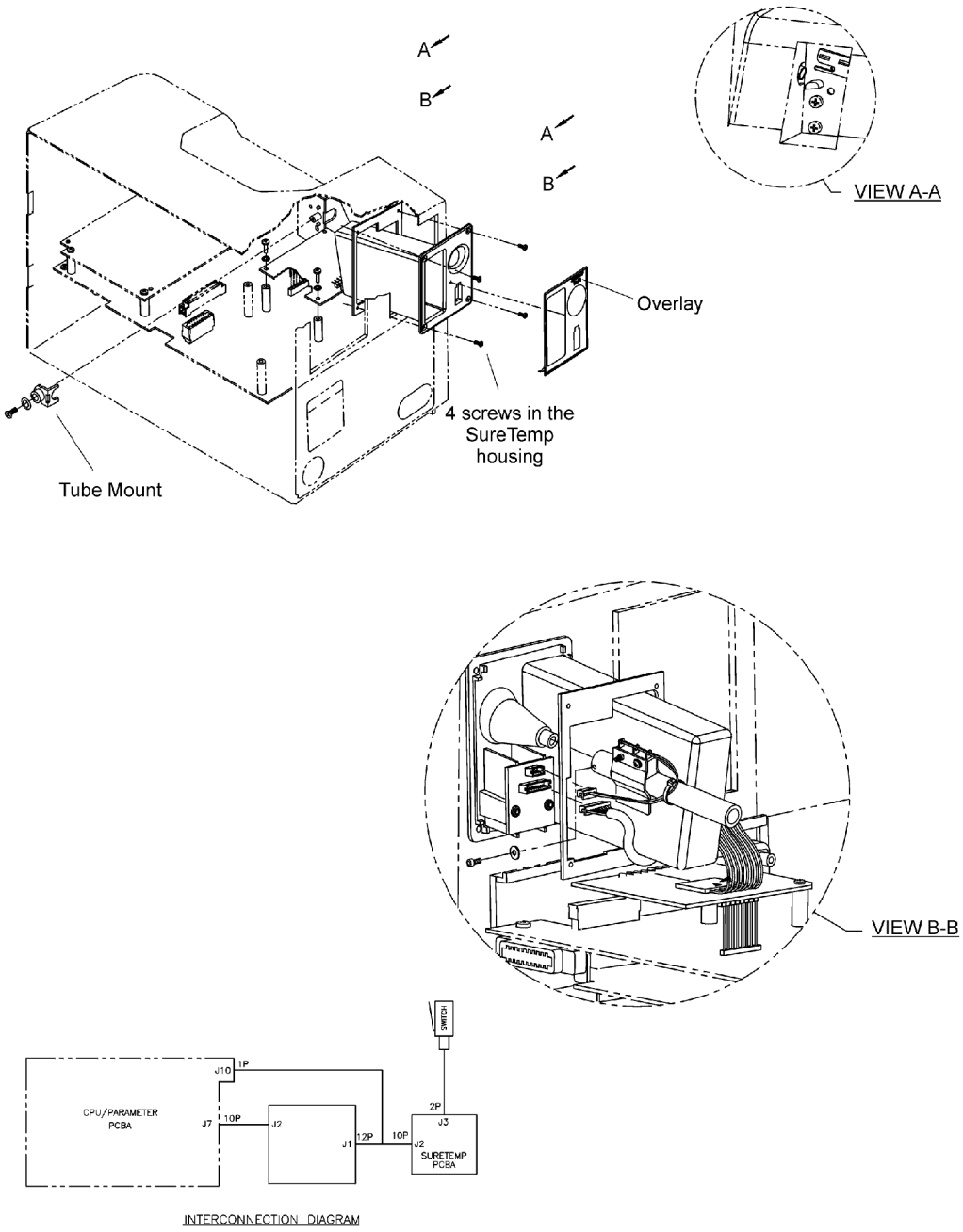


Figure 8-9. SureTemp 678 Assembly

SECTION 9
PERFORMANCE CHECK

9.0 PERFORMANCE CHECK.

9.1 Overview. InvivoMDE recommends a yearly performance check to verify all functions on the Escort M10 monitor. Perform only the tests necessary for the options and parameters installed in your monitor. A checklist is included at the back of this section which may be photocopied and completed each time the performance check is done. At the conclusion of the performance check, turn the power switch to the **Power Standby** (Off) position, then back **ON** again. Verify that all default settings return.

9.2 Required Test Equipment. The following equipment (or equivalent) is necessary to do the performance tests. Refer to the manufacturer's operating procedures for detailed information. All test equipment used should be in good working condition and calibrated, if necessary.

- MDE Datasim 6000, 6100 Patient Simulator or similar
- Resistive 3-lead and 5-lead ECG cables and leads
- Two (2) blood pressure cables
- IEC-601 Continuity Tester
- Variac/current box 110VAC
- Variac/current box 220VAC
- DC power supply with 3.5 mm connector, 20VDC/3A
- NELLCOR finger probe and cable
- MASIMO finger probe and cable
- NIBP cuff and hose
- Fogg Temperature Simulator TP400/700
- Fogg BP Simulator BP-600
- Stopwatch
- Digital Manometer (EDI or equivalent)
- Biotek 505 Electrical Safety Tester or similar with printer and interface cable
- Barometer
- DMM, 3 1/2 digit or better
- VGA monitor
- Microstream ETCO2 Calibration Kit

Begin with a thorough visual inspection of the unit. Inspect the power cord for cracks or exposed conductors. Replace power cord, if defective.

9.3 Safety Tests. Perform the following Safety Tests.

WARNING

Disconnect the AC power cord, remove battery or batteries (if installed), and disconnect all cables connected to the monitor before performing the safety tests.

9.3.1 Chassis Ground Test. Perform the Chassis Ground Test as follows:

a. Connect the AC plug of the IEC-601 Continuity Tester to the AC input of the monitor.

b. Touch test probe to ground post (if present), or to the metal casing on either the I/O or VGA OUT connector on back of monitor.

c. Activate the tester and verify that the green **PASS LED** is illuminated.

9.3.2 Current Leakage Test. Perform the Current Leakage Test as follows:

a. Power-up the Biotek 505 instrument and the printer.

b. Connect the printer to the Biotek and verify it is ON-LINE.

c. Connect the power cable of the Biotek to the monitor.

d. Connect the RED test lead jack to the ground post (if present), or to the metal casing on either the I/O or VGA OUT connector on back of monitor.

e. Connect the ECG leads from the Biotek to the monitor.

f. Press the PROGRAM key on the Biotek until the display indicates Pro2.

g. Verify the following LEDs are lit to indicate corresponding tests are enabled: “ohm”, “µA” “V” “ECG Leak”, “Rev Pol”, Open Gnd”, “Print”, and “Program” LED blinking.

h. Turn **ON** the monitor.

i. Toggle the **ON/Power Standby** key while testing.

j. At the end of the test check the printout. Verify the Ground Wire Resistance does not to exceed 0.1 ohm, current consumption is between 0.1 and 0.6A, “Chassis Leakage” current is less than 100µA, and the “Patient Lead Leakage” current in the “isolation mode” is less than 20µA at 120VAC and 50µA at 230VAC.

9.4 Mainframe Checks. Perform the following Mainframe Checks.

9.4.1 Keypad Function Check. Perform the Keypad Function Check as follows:

a. Verify all membrane keys respond when pressed and rotary knob responds when it is rotated and pressed.

b. Violate an Alarm limit to cause Alarm to activate and verify the **“ALARM”** LED flashes.

c. Press the **ALARM SILENCE** control key and verify the “ALARMS SUSPENDED” countdown is displayed.

9.4.2 Mainframe Software. Perform the Mainframe Software check as follows:

a. Press the **NORMAL SCREEN** function key.

b. Press the **SETUP** function key.

c. Select **MORE** twice.

d. Select **TEST** to display the parameter communication status codes on the screen.

Each parameter listed is followed by a communications code and its software version. Communication status codes are as follows:

OK • No faults detected; normal operating state

I • Parameter is INHIBITED by user configuration in monitor (parameter selection; i.e., RESP vs. RESPCO2, indicating that only one source of respiration may be active at a given time, e.g., Respiration via impedance pneumography vs. Respiration via ETCO2)

D • Parameter is DISABLED by user configuration in monitor (PRAM AVAIL field in power-up defaults)

V	• Version (protocol revision) mismatch between parameter and monitor; contact InvivoMDE Technical Support
#	• Any numeric codes displayed for COMM status should be relayed to InvivoMDE Technical Support for further direction

9.4.3 Date and Time Check. Perform the Date and Time Check as follows:

a. Press the **NORMAL SCREEN** function key.

b. Press the **SETUP** function key.

c. Select **MORE**.

d. Select **CLOCK**.

e. Check the monitor for correct date and time.

f. Make changes as necessary. Refer to the **Escort M10 Vital Signs Monitor Operations Manual** to change the date and time.

9.4.4 VGA Output Check. If applicable, perform the VGA Output Check as follows:

a. Connect a VGA monitor to the 15 pin D-sub connector of the monitor.

b. Verify the Escort M10 monitor display. Verify the VGA monitor text and graphics displayed are normal.

9.4.5 System AC Current Check. Perform the System AC Current Check as follows:

a. Remove the battery or batteries from the monitor.

b. Plug the power cord of the monitor into a variac.

c. Set the variac at 115 VAC. Ensure that the current meter reads less than 500 mA.

d. Reinstall the battery or batteries of the monitor when complete.

9.4.6 External DC Operation. If applicable, perform the External DC Operation check as follows:

a. Remove the AC power source from the monitor.

b. Remove the battery or batteries, if present.

c. Set an external DC power supply (rated at a minimum of 45 VA) to 20 ± 8 VDC.

d. Connect the DC output to the external DC connector at the back of the monitor using the 3.5 mm connector (center pin positive). Verify that the monitor operates normally.

9.4.7 Battery Operation Test. Perform the Battery Operation Test as follows:

NOTE

Never discharge the battery completely. To ensure long battery life, always recharge battery immediately after use. Battery should be replaced every two (2) years regardless of test results. Used battery should be recycled or disposed of properly.

NOTE

Battery test should be performed on recently charged battery.

a. Remove the AC power cord from the monitor and verify the monitor remains on with normal operation.

b. Ensure that both the **AC ON** and **BATTERY CHARGING** LEDs are off.

c. Reconnect the AC power cord to the monitor.

d. Verify the **AC ON** LED is on with AC power.

9.5 ECG Tests. Perform the following ECG Tests.

NOTE

When using a patient simulator, the tolerance factor of the simulator must be considered in determining if the monitor is within tolerance.

9.5.1 ECG Lead Position Check. Perform the ECG Lead Position Check as follows:

a. Connect a 5-lead ECG cable to a calibrated patient simulator.

b. Connect the ECG cable to the ECG connector of the monitor.

c. Press the **NORMAL SCREEN** function key.

d. Using the rotary knob, select the **ECG** icon.

e. Select **LEAD SEL**.

f. Select **LEAD** to highlight the **5** mode.

g. Select **MORE** twice.

h. Select **MM/S** to set the sweep speed to **25** mm/sec.

i. Verify that an acceptable ECG waveform is displayed in all lead positions.

9.5.2 ECG Lead Fail Test. Perform the ECG Lead Fail Test as follows:

a. Ensure that the monitor is still set to 5-lead mode.

b. Verify the "**CHK LEADS**" message appears below the ECG trace within 10 seconds when any patient lead is disconnected (LL, LA, RA, RL, and C).

c. Verify the "**CHK LEADS**" message appears below the RESP trace (if applicable) when LA or RA lead is disconnected.

d. Verify that when any patient lead is disconnected and reconnected, the baseline returns to normal within five (5) seconds.

9.5.3 ECG Alarm Function Check. Perform the ECG Alarm Function Check as follows:

a. Press the **NORMAL SCREEN** function key.

b. Using the rotary knob, select the **ECG** icon.

c. Select **ALARM ON/OFF** to set the alarm tone to **ON**.

d. Set the ECG output of the patient simulator higher than the high alarm limit.

e. Verify that the alarm tone sounds.

f. Set the patient simulator ECG output lower than the low alarm limit.

g. Verify that the alarm tone sounds.

h. If the monitor is equipped with a recorder, observe alarm recording when the alarm record is enabled.

i. Verify that the red ALARM LED is flashing.

9.5.4 Pacer Flag and Artifact Check. Perform the Pacer Flag and Artifact Check as follows:

a. Set simulator to output a paced waveform.

b. Press the **NORMAL SCREEN** function key.

c. Using the rotary knob, select the **ECG** icon.

d. Set **PACE ON/OFF** to **ON**.

e. Verify that the pace spikes are replaced with uniform pacer flags and that the heart rate indicated on the monitor returns to the simulator rate.

9.5.5 Verify No ECG Count in Asystole Mode. Verify no ECG count in Asystole Mode as follows:

a. Set simulator to ASYSTOLE Mode.

b. Verify the ECG count goes to 00.

c. Verify the monitor is in 5-lead mode, select lead I.

d. Set ECG trace size to maximum.

e. Verify ECG count remains at 00 for at least 10 seconds.

f. Set ECG to standard trace size.

g. Return monitor to lead II.

h. Set simulator to NSR.

i. Check **QRS TONE:** Select **TONE** and listen for beep corresponding to each R-wave.

9.5.6 ECG Calibration Check. Perform ECG Calibration Check as follows:

NOTE

Disconnect all parameter cables (except the ECG cable) during this test. Ensure that ECG is set to monitor Lead II.

a. Units with Recorders. Check units with recorders as follows:

(1) Connect an ECG 1mV calibrated signal to the monitor's ECG input connector.

(2) Set the monitor for **SNGL TRACE** mode in the **RECORDER SETUP** menu.

(3) Turn **OFF** the recorder **DELAY** in the **RECORDER SETUP** menu.

(4) Press the **NORMAL SCREEN** function key.

(5) Using the rotary knob, select the **ECG** icon.

(6) Press the **RECORD** function key.

(7) Select **SIZE**.

(8) Select **CAL**.

(9) Verify that the R-wave amplitude is 1mV peak-to-peak from the isoelectric line to the R-wave peak ± 0.1 mV.

(10) Verify the Cal pulse is 1mV peak-to-peak.

b. Units without Recorders. Check units without recorders as follows:

(1) Perform Steps 1 and 2, and 5 - 8 as described above.

(2) Ensure that the calibration pulse generated on the screen and the ECG amplitude are within 15% measuring the peak-to-peak from the isoelectric line to the R-wave peak.

9.6 Respiration Tests. Perform the following Respiration Tests.

9.6.1 Apnea Alarm Check. Perform the Apnea Alarm Check as follows:

a. Set the simulator to produce an apnea greater than 10 seconds.

b. While in the **RESPIRATION SETUP** menu of the monitor, set **ALM ON/OFF** to **ON**.

c. Set the **APNEA DELAY** to **10** seconds.

d. Ensure that the alarm sounds after the delay indicated.

e. Verify that the front panel ALARM LED flashes while the alarm is in progress.

f. Return the simulator respiration rate to 15 or 20 BPM.

9.6.2 High/Low Alarm Function Check. Perform the High/Low Alarm Function Check as follows:

a. Turn on RESP alarm tone by setting **ALM ON/OFF** to **ON**.

b. Set the RESP output of the patient simulator higher than the high alarm limit.

c. Ensure that the alarm tone sounds while the front panel ALARM LED is flashing.

d. Set the patient simulator RESP output lower than the low alarm limit.

e. Ensure that the alarm tone sounds while the front panel ALARM LED is flashing.

9.6.3 RESP Calibration/Check. Perform the RESP Calibration Check as follows:

a. Connect an ECG cable with lead wires to the monitor's ECG input connector.

b. Tie the LA-RA inputs to ground reference.

c. Measure the voltage at TP11 on the CPU board with reference to isolated ground. Voltage should read 0VDC ± 0.02VDC.

d. Adjust VR3 if voltage is not within specified range.

9.7 SPO2 Tests. Perform the following SPO2 tests.

9.7.1 Finger Sensor Check (Nellcor & Masimo). Perform the Finger Sensor Check as follows:

a. Connect Finger Sensor.

b. Verify "**SPO2 SRCH**" message.

c. Insert an index finger into the sensor. Place LED over fingernail.

d. Verify that the SPO2 waveform and saturation reading appear on the screen after a few seconds.

e. Disconnect Finger Sensor.

f. Verify "**NO SENSOR**" message flashes on the screen.

9.7.2 High/Low Alarm Function Check. Perform the High/Low Alarm Function Check as follows:

a. With the finger sensor connected to the monitor, insert an index finger into the sensor.

b. Turn on SPO2 alarm tone by setting **ALM ON/OFF** to **ON**.

c. Set the alarm limits outside of values.

d. Verify that the alarm tone sounds while the front panel ALARM LED is flashing.

e. Turn off SPO2 alarm tone by setting **ALM ON/OFF** to **OFF**.

9.7.3 Check SPO2 Voltage Verification/Adjustment (Positive Voltage). Check SPO2 positive voltage adjustment as follows:

a. Measure between J6 pin 2 (ground) and J6 pin 5 (SPO2+ voltage) Rev B CPU and higher boards, J6 pin 4 for SPO2+ voltage for Rev A boards.

b. Masimo CPU boards Rev B should read +14.1 to +15.2 VDC.

c. Nellcor CPU boards should read between + 15.0 to +17.0VDC.

d. Masimo CPU boards Rev C and higher should read 14.3 +/- 0.1 VDC, adjust VR10 if not within tolerance.

9.7.4 Check SPO2 Voltage Verification/Adjustment (Negative Voltage). Check SPO2 negative voltage adjustment as follows:

a. Measure between J6 pin 2 (ground) and J6 pin 8 (SPO2– voltage) Rev B CPU and higher boards, J6 pin 6 for SPO2– voltage for Rev A boards.

b. Masimo CPU boards Rev B should read – 14.1 to – 15.2 VDC.

c. Nellcor CPU boards should read between – 15.0 to – 17.0 VDC.

d. Masimo CPU boards Rev C and higher should read –14.3 +/- 0.1 VDC, adjust VR9 if not within tolerance.

9.8 NIBP Tests. Perform the following NIBP Tests.

9.8.1 Inflation Time and Maximum Pressure Check. Perform the Inflation Time and Maximum Pressure Check as follows:

a. Connect a digital manometer to the right-hand NIBP fitting.

b. Press the **NORMAL SCREEN** function key.

c. Press the **SETUP** function key.

d. Select **MORE** twice.

e. Select **TEST**.

f. Select **NIBP TEST** until **ADJ** mode is highlighted.

g. Press **NORMAL SCREEN**, then use the rotary knob to select the **NIBP** icon.

h. Simultaneously, start a stopwatch and select **START**.

i. Stop the watch when the manometer reads 200mmHg. The time must be equal to or less than 15 seconds.

j. Once the pump shuts off, note the reading on the manometer. The pressure shall be between 270 and 330.

9.8.2 Overpressure Detection Check. Perform the Overpressure Detection Check as follows:

a. Verify that the monitor is configured in **ADULT** mode in the **SYSTEM SETUP** menu.

b. Connect the manometer using a 'Y' adapter and reservoir bottle to both bulkhead connectors on the monitor.

c. Press **NORMAL SCREEN**, then use the rotary knob to select the **NIBP** icon.

d. Wait until the pump stops and then continue to pump the system using the manometer's inflation bulb.

e. Verify that the overpressure switch activates and vents the system between 255 and 280 mmHg.

f. Press **STOP**, and bleed off any additional air from the system.

g. Configure the monitor to **NEO** mode in the **SYSTEM SETUP** menu and return to the **NIBP SETUP** Menu.

h. Select **START**.

i. Wait until the pump stops and then continue to pump the system using the manometer's inflation bulb.

j. Ensure that the overpressure switch activates and vents the system between 155 and 170 mmHg.

k. Select **STOP**, and bleed off any additional air from the system.

l. Switch monitor back to **ADULT** mode.

9.8.3 Leak Test. If a leak is suspected, take the following steps:

a. Attach an adult hose and cuff to monitor. Wrap cuff around a mandrel.

b. Press the **NORMAL SCREEN** function key.

c. Press the **SETUP** function key.

d. Select **MORE** twice.

e. Select **TEST**.

f. Select **NIBP TEST** until **LEAK** is highlighted.

g. Press **NORMAL SCREEN**, then use the rotary knob to select the **NIBP** icon.

h. Select **START**. The "**LEAK TEST**" message is displayed.

i. The monitor will then automatically check for a leak. If no leak is detected, a "**NO LEAK**" message is displayed. If a leak is detected, a "**LEAK**" message is displayed, and should be repaired by qualified service personnel.

9.8.4 Calibration Check. Calibration of the monitor should be checked at least once a year, or when there is doubt about the validity of the pressure readings. The test procedure is designed to confirm the accuracy of the monitor as well as to diagnose pneumatic leaks. To perform a calibration check, follow these steps:

a. Connect a manometer, reservoir, and pump bulb to the right-hand NIBP fitting.

b. Press the **NORMAL SCREEN** function key.

c. Press the **SETUP** function key.

d. Select **MORE** twice.

e. Select **TEST**.

f. Select **NIBP TEST** until **ADJ** is highlighted.

g. Press the **NORMAL SCREEN** function key.

h. Verify "**CUFF = 00**" (If other than 00 is displayed, perform **"NIBP Offset Adjustment"** described later in this section).

i. Pump the system using the manometer's inflation bulb until 240 mmHg is shown on the manometer.

j. Verify the unit is displaying 240 mmHg ± 2 mmHg (If not within limits, perform **"NIBP Gain Adjustment"** described later in this section).

9.8.5 NIBP Offset Adjustment. Perform NIBP Offset Adjustment as follows:

a. Bleed all pressure from the system.

b. On the CPU board, measure the voltage between U55 pin 8 and reference isolated ground.

c. Voltage should be 1.255VDC ± 0.04. If not within limits, adjust VR6 on the CPU board.

9.8.6 NIBP Gain Adjustment. Perform NIBP Gain Adjustment as follows:

a. Pressurize the system to 200 mmHg as indicated on the manometer.

b. Adjust VR4 on the CPU board until the pressure is within specified limits.

9.9 Temperature Tests. Perform the following Temperature Tests.

9.9.1 YSI Temperature Check. Perform the YSI Temperature Check as follows:

a. Press the **NORMAL SCREEN** function key.

b. Using the rotary knob, select the **TMP1** icon.

c. Check for no temperature indication (dashed lines on the screen).

d. Connect the temperature simulator to the **TEMP 1** input of the monitor.

e. Set the simulator to 25° C.

f. Check that the temperature on monitor reads within 0.2° for both YSI 400 and YSI 700 type probes.

g. Repeat the above for 37° C and 40° C.

h. Repeat the above steps for **TMP2** (if applicable).

9.9.2 High/Low Alarm Function Check. Perform the High/Low Alarm Function Check as follows:

a. Turn on the **TMP1** alarm tone by setting **ALM ON/OFF** to **ON**

b. Set the temperature simulator output higher than the high alarm limit.

c. Ensure that the alarm tone sounds while the front panel ALARM LED is flashing.

d. Set the temperature simulator output lower than the low alarm limit.

e. Ensure that the alarm tone sounds while the front panel ALARM LED is flashing.

f. Repeat the above steps for **TMP2** (if applicable).

9.9.3 SureTemp Temperature Check. Perform the SureTemp Temperature Check as follows:

a. Turn monitor ON.

b. Verify SureTemp label on screen.

c. Allow SureTemp to initialize (within 1 minute).

d. Remove probe from well.

e. Verify the "**T1 READY**" message within 30 seconds.

9.10 IBP Tests. Perform the following IBP Tests.

9.10.1 ZERO Check. Perform the IBP ZERO Check as follows:

a. Configure an available trace for BP1.

b. Press the **NORMAL SCREEN** function key.

c. Using the rotary knob, select the **BP1** icon.

d. Plug the waveform simulator into the monitor's BP1 connector.

e. Ensure that a flashing "**ZERO BP1**" message appears.

f. Set the simulator to zero pressure.

g. Select **ZERO BP1**.

h. Ensure that the flashing "**ZERO BP1**" message disappears.

i. Repeat the above procedures for **BP2** and **BP3** if installed.

9.10.2 Waveform Check. Perform a Waveform Check as follows:

a. Set the simulator to output dynamic pressure (e.g., 120/80).

b. Verify that a standard invasive blood pressure waveform is present.

c. Repeat the above procedures for **BP2** and **BP3** if installed.

9.10.3 Static Gain Accuracy Check. Perform the Static Gain Accuracy Check as follows:

a. Re-zero the IBP waveform.

b. Set the simulator to output a static pressure of 200 mmHg.

c. Verify that a reading of 200 mmHg is displayed on the monitor with an accuracy of ± 1 mmHg.

d. If not within limits, adjust VR5 on the CPU board.

e. Repeat the above procedures for **BP2** and **BP3** if installed.

9.10.4 High/Low Alarm Function Check. Perform the High/Low Alarm Function Check as follows:

a. Turn on the **BP1** alarm tone by setting **ALM ON/OFF** to **ON**

b. Set the patient simulator BP1 output higher than the high alarm limit.

c. Verify that the alarm tone sounds while the front panel ALARM LED is flashing.

d. Set the patient simulator BP1 output lower than the low alarm limit.

e. Verify that the alarm tone sounds while the front panel ALARM LED is flashing.

f. Repeat all IBP tests for **BP2** and **BP3** (if installed).

9.11 End Tidal CO2 Tests. Perform the following ETCO2 tests.

9.11.1 Test Setup. Perform the Test Setup as follows:

a. Plug in the **ECG** cable, enable **RESP** and **CO2** on traces 2 and 3 respectively.

b. Using the rotary knob, select the **CO2** icon and verify **"NO SENSOR"** message appears on **CO2** trace.

c. Verify **RESP (ECG RESP)** rate is equal to DataSim rate.

9.11.2 Power-Up Sequence Check. Perform the Power-Up Sequence Check as follows:

a. Plug in the **CO2** sensor.

b. The "**WARM UP**" message should be present. When the sensor completes the warm up process, the message is removed from display.

9.11.3 Verify CO2 Operation. Verify proper CO2 operation as follows:

a. Breathe into sensor.

b. A squared pulse should be seen on the **CO2** trace. The **RESP (CO2 RESP)** count should equal your breath rate, and the **CO2** value should be between 35 and 60mm.

9.11.4 Verify Apnea Operation. Verify proper CO2 apnea alarm operation as follows:

a. Enable **CO2** alarm and stop breathing into the sensor.

b. The **APNEA** alarm should sound after the **APNEA** delay time preset under **RESP**.

9.11.5 Check Barometric Pressure Calibration. Check for proper barometric pressure calibration as follows:

a. Check that barometric pressure displayed on the **SW STAT** page is no more than ±7mmHg from the actual pressure.

9.11.6 High/Low Alarm Function Check. Perform the High/Low Alarm Function Check as follows:

a. Turn on the **CO2** alarm tone by setting **ALM ON/OFF** to **ON**

b. Set alarm limits outside of displayed values.

c. Confirm alarm sounds and the front panel ALARM LED is flashing.

9.11.7 Cycle Test. Perform the Cycle Test as follows:

a. Turn off the **CO2** parameter by setting **CO2 ON/OFF** to **OFF**, and verify the **RESP (ECG RESP)** count returns to the DataSim rate.

b. Turn on the **CO2** parameter.

9.11.8 Unplug the Sensor. Unplug the sensor as follows:

a. Unplug the **CO2** sensor and verify the "**NO SENSOR**" message appears.

9.11.9 Calibration Hours Check. Perform the Calibration Hours Check as follows:

a. Press the **NORMAL SCREEN** function key.

b. Press the **SETUP** function key.

c. Select **MORE** twice.

d. Select **TEST**.

e. Select **STAT INFO SW**.

f. Select **CAL ON**.

g. Compare the Calibration hours with the log sheet at the end of this chapter. Calibration must be performed every 4000 hours or one (1) year.

9.11.10 CO2 Calibration. Perform CO2 Calibration as follows:

WARNING

Do not check CO2 values from the measuring mode. This mode corrects the CO2 value for BTPS (Body, Temperature, Pressure, Saturation) which assumes that alveolar gases are saturated with water vapor. The calibration check mode disables this correction.

a. Press the **NORMAL SCREEN** function key.

b. Press the **SETUP** function key.

c. Select **MORE** twice.

d. Select **TEST**.

e. Select **STAT INFO SW**.

f. Select **CAL ON**.

g. After approximately 5 seconds, the **"hours of operation"** is displayed. After approximately 15 seconds, the **"CONNECT GAS & PRESS START"** message is displayed.

h. Connect the Microstream ETCO2 Calibration Kit to the monitor.

i. Press and hold the button on the top of the CO2 canister.

j. When the **PCO2** value appears, select **START**.

k. A **"CAL IN PROGESS"** message appears.

l. Stop pressing the button on the top of the CO2 canister, **WHEN** a **"REMOVE GAS-CALCULATING"** message appears (approximately 30 seconds after **"Start"** is selected).

m. Wait for a **"CAL SUCCESSFUL-DONE"** message to appear (approximately 1 minute after **"Start"** is selected).

n. Recycle system power to clear the **"CAL SUCCESSFUL-DONE"** message.

o. Disconnect the Microstream filterline and calibration gas canister.

p. Calibration is complete. Document in the **CO2 Calibration Log** at the end of this section.

9.12 Cardiac Output (CO) Tests. Perform the following CO Tests.

NOTE

To perform the following Cardiac Output tests, precision resistance (1%) must be applied to the reference designation pins on the monitor's CO connector, as indicated for each test.

Table 9-1. CO Connector Pin Designations

Pin Designation	Signal
1	BAB
2	THB
3	BAC
7	THD
8	THA
10	BAA
14	FL
4, 5, 6, 11, 12, 13, 15, 16 and 17	SHLD_CO

9.12.1 Blood Temperature (Tb) Tolerance Check. Perform the Blood Temperature Tolerance Check as follows:

a. Configure Trace 3 for CO.

b. Press the **NORMAL SCREEN** function key.

c. Using the rotary knob, select the **CO** icon.

d. Using Table 9-2 as a guide, set the resistance values across THA and THB and across THB and THD, as indicated.

e. Observe that for each setup, the blood temperature (Tb) displayed on the monitor screen is within tolerance.

Table 9-2. Cardiac Output Calibration Values for Blood Temps

Resistance Across THA-THB	Resistance Across THB-THD	Blood Temperature
9.76 kohms	30.484 kohms	17.0 ± 0.1° C

Table 9-2. Cardiac Output Calibration Values for Blood Temps (Continued)

Resistance Across THA-THB	Resistance Across THB-THD	Blood Temperature
9.76 kohms	14.000 kohms	37.0 ± 0.1° C
9.76 kohms	11.304 kohms	43.0 ± 0.1° C

9.12.2 Flow Through (Ti) Tolerance Check. Perform the Flow Through Tolerance Check as follows:

a. Configure Trace 3 for CO.

b. Press the **NORMAL SCREEN** function key.

c. Using the rotary knob, select the **CO** icon.

d. Using Table 9-3 as a guide, set the resistance values across BAB and FL, as indicated (see Table 9-1 for correct pin designation).

e. Observe that for each setup, the flow through temperature (Ti) displayed on the monitor screen is within tolerance..

Table 9-3. Cardiac Output Calibration Values for Flow Through Temps

Resistance Across BAB-FL	Flow Through Temperature
84.510 kohms	5.0 ± 0.1° C
78.850 kohms	10.0 ± 0.1° C
62.760 kohms	25.0 ± 0.1° C

9.12.3 Bath Tolerance Check (Ti). Perform the Bath Tolerance Check as follows:

a. Configure Trace 3 for CO.

b. Press the **NORMAL SCREEN** function key.

c. Using the rotary knob, select the **CO** icon.

d. Using Table 9-4 as a guide, set the resistance values across BAA and BAC and across BAB and BAC, as indicated (see Table 9-1 for correct pin designation).

e. Observe that for each setup, the bath temperature (Ti) displayed on the monitor screen is within tolerance.

Table 9-4. Cardiac Output Calibration Values for Bath Temps

Resistance Across BAA-BAC	Resistance Across BAB-BAC	Bath Temperature
94.980 kohms	19.500 kohms	0.0 ± 0.1° C
58.750 kohms	11.940 kohms	10.0 ± 0.1° C
30.000 kohms	6.000 kohms	25.5 ± 0.1° C

PERFORMANCE CHECKLIST

MODEL: _____ **TECHNICIAN:** _____
SERIAL NUMBER: _____ **DATE:** _____

SAFETY TESTS

Chassis Ground Test ..... OK _____
Current Leakage Test ..... OK _____

MAINFRAME CHECK

Keypad Function Check ..... OK _____
Mainframe Software ..... OK _____
Date and Time Check ..... OK _____
Line Frequency Check ..... OK _____
VGA Output Check (If Applicable) ..... OK _____
System AC Current Check ..... OK _____
External DC Operation ..... OK _____
Battery Operation Test ..... OK _____

ECG TESTS

ECG Lead Position Check ..... OK _____
ECG Lead Fail Tests ..... OK _____
ECG Alarm Function Check ..... OK _____
Pacer Flag and Artifact Check ..... OK _____
Verify No ECG Count in Asystole Mode ..... OK _____
ECG Calibration Check ..... OK _____

RESPIRATION TESTS

Apnea Alarm Check ..... OK _____
High/Low Alarm Function Check ..... OK _____
RESP Calibration Check ..... OK _____

SPO2 TESTS

Finger Sensor Check (Nellcor & Masimo) ..... OK _____
High/Low Alarm Function Check ..... OK _____
Check SPO2 voltage verification / adjustment (Positive voltage) ..... OK _____
Check SPO2 voltage verification / adjustment (Negative voltage) ..... OK _____

NIBP TESTS

Inflation Time and Maximum Pressure Check ..... OK _____
Overpressure Detection Check ..... OK _____
Leak Test ..... OK _____
Calibration Check ..... OK _____

TEMPERATURE TESTS

YSI Temperature Check.....OK _____
High/Low Alarm Function Check .....OK _____
SureTemp Temperature Check.....OK _____

IBP TESTS

ZERO Check.....OK _____
Waveform Check .....OK _____
Static Gain Accuracy Check .....OK _____
High/Low Alarm Function Check .....OK _____

END TIDAL CO2 TESTS

Test Setup.....OK _____
CO2 Power-Up Sequence Check.....OK _____
Verify CO2 Operation.....OK _____
Verify Apnea Operation.....OK _____
Check Barometric Pressure Calibration.....OK _____
High/Low Alarm Function Check .....OK _____
Cycle Test.....OK _____
Unplug the Sensor.....OK _____
Calibration Hours Check .....OK _____
CO2 Calibration.....OK _____

CARDIAC OUTPUT TESTS

Blood Temperature (Tb) Tolerance Check.....OK _____
Flow Through (Ti) Tolerance Check .....OK _____
Bath Tolerance Check (Ti).....OK _____

CO2 CALIBRATION LOG

DATE	MODEL	S/N	HOURS OF OPERATION	COMPLETED BY	NOTES

SECTION 10
CARE AND CLEANING

10.0 CARE AND CLEANING.

WARNING

To avoid electric shock, unplug the AC power cord before cleaning.

CAUTION

Do not immerse the instrument, its switches, cables, connectors or accessories in liquids. Do not use caustic or abrasive cleaners that will damage the housing. If disinfectants or alcohol must be used, apply sparingly to nonabrasive cloth first and gently wipe surfaces taking care not to let pool on plastic surfaces.

10.1 Guidelines for Cleaning the Monitor. Use the following guidelines and considerations when cleaning the Escort M10 monitor:

a. Clean the monitor, cuffs, and hoses as required per hospital procedures. Only use a lint free, nonabrasive cloth that has been slightly dampened with mild detergent.

b. Avoid harsh cleaning solutions that may harm plastic surfaces.

c. Do not immerse monitor, cuffs, or hoses in liquids.

d. Do not clean with isopropyl alcohol or other solvents that may harm plastics.

e. Do not spray or pour liquids directly onto the monitor or its accessories.

f. Do not allow any liquid to come into contact with the power connector, fuse holder, or switches.

g. Do not allow any liquids to penetrate connectors or the monitor chassis.

10.2 Repacking and Shipping the Monitor. Use the following guidelines if you need to ship the Escort M10 monitor for repair or relocation:

CAUTION

Failure to follow the guidelines below may result in damage or loss. Equipment damaged due to improper packaging is not covered in the monitor's warranty, nor is the loss of equipment due to improper or inadequate shipping procedures.

a. The equipment must be packed carefully, ideally using the original shipping carton with foam packing material.

b. If the original carton is not available, use a similar carton. Place the equipment in a plastic bag or air bubble cushioning material. Fill the bottom of the carton with approximately five (5) centimeters of polystyrene packing material. Place the equipment on the layer of packing material, and then fill all the remaining space in the carton with packing material.

c. Seal the carton adequately.

d. If shipping to InvivoMDE for repair, a Return Material Authorization number (RMA#) must be obtained. To obtain an RMA number, call InvivoMDE Technical Support at one of the telephone numbers listed at the front of this manual. It is necessary to have the model and serial number of the equipment at hand along with a detailed description of the reason(s) why it needs to be returned to the factory.

SECTION 11
ESCORT M10 MODULES

11.0 ESCORT M10 MODULES.

11.1 Overview. There are several modular (user-movable) components that can be shared by all Escort M10 monitors (see below and Figure 11-1).

- The **Transceiver Module** – provides two-way wireless communication to the ESCORT-Link or ESCORT Vision Central Station, and serves as a repeater for the wireless network.
- The **Telemetry Receiver Module** – allows for bedside monitoring of telemetry patients.
- The **CIS Communication Module** – provides serial and Ethernet TCP/IP interface to HIS/CIS systems for automated charting.

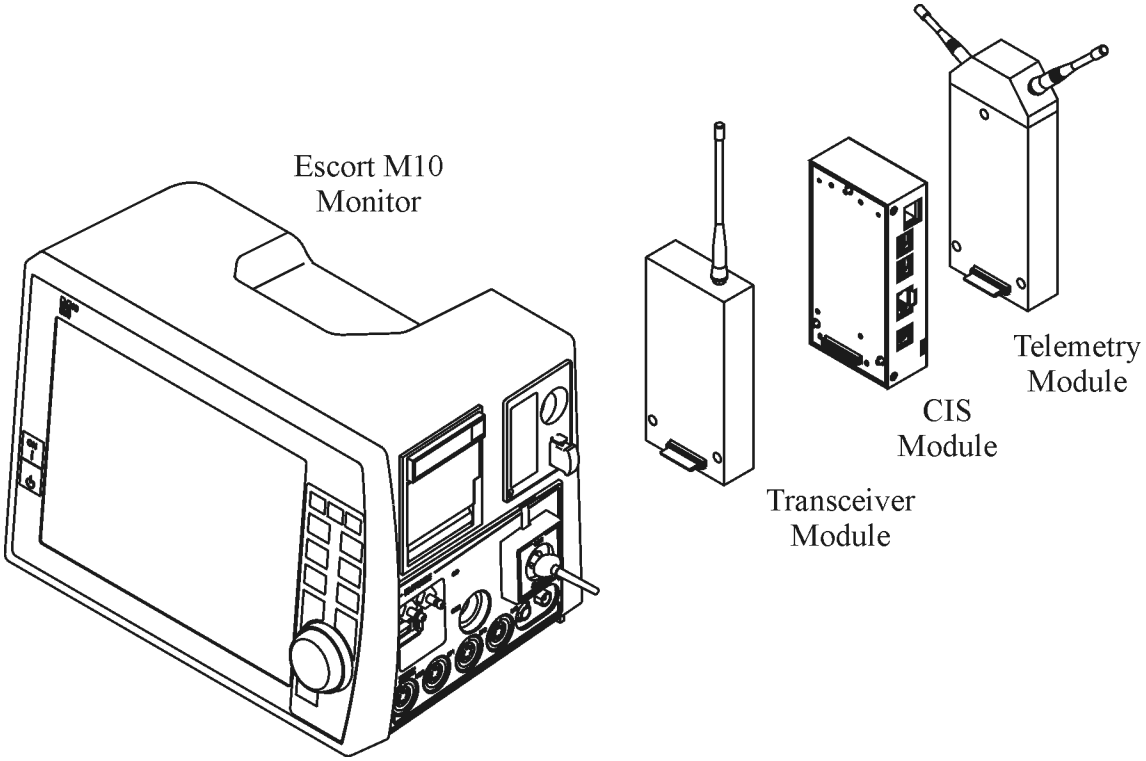


Figure 11-1. Escort M10 Modularity

11.2 Transceiver Module.

WARNING

The monitor power should be OFF and the power cord should be disconnected from its AC source when you attach or remove a Transceiver Module. Do not open the module. Refer all servicing to qualified technical personnel.

11.2.1 Attaching the Transceiver Module to the Monitor. Perform the following steps to attach the transceiver module to the Escort M10 monitor.

a. Turn the monitor power Off by pressing the **Power Standby** key and **disconnect from AC power source**. Proceed with the following steps after the monitor power has been turned off for approximately twenty (20) seconds.

b. Plug the transceiver into the **"Add-On Module Interface Connector"** on the back of the monitor, making sure to line up the three screws on the transceiver with the three screw holes on the back of the monitor. Refer to the **"Rear Panel"** write-up in Section 2 for the location of this connector.

c. Use a flat head screwdriver or 3/16"-hex nut driver to turn each of the three screws until the transceiver is attached snugly to the back of the monitor.

d. Ensure that the transceiver antenna is screwed into place on the top of the transceiver.

e. Connect the monitor to an AC power source.

f. Turn the monitor power on by pressing the **ON** key.

g. The green LED on the transceiver indicates the transceiver's communication status:

- **ON** - If the LED is ON (except for a momentary flicker approximately every 20 seconds), the transceiver has established a communication link.
- **OFF** - If the LED is OFF, there is currently no communication to or from the transceiver.
- **Flashing** - If the LED is flashing, the transceiver is attempting to communicate information, but no steady communication link with a central station has been established.

11.2.2 Setting Up Transceiver Communications. Each transceiver has a unique ID code (a four-digit alphanumeric code) which is assigned at the factory. There are fourteen channels through which the transceiver can send and receive data. The transceiver ID and the channel in use must be recognized by both the monitor and central station with which it is communicating.

The following steps ensure the monitor recognizes the transceiver information. See the ESCORT Vision Central Station Reference Manual for information on setting up communications.

a. **Step 1: Verify/Set the Transceiver Channel.** To optimize communication between Escort M10 bedside monitors and the central station, a few network configuration issues should be considered. These considerations include assigning the proper operating channel and mode of the monitor's transceiver:

- If the monitor is going to communicate alternately with two or more central stations, it should be in **AUTO** mode. This mode allows the monitor's transceiver to constantly be in a search mode of all fourteen operating channels until it locks in on a central station's channel to which it is currently assigned. Thus, changes in the monitor's central station assignments only require user configuration changes at the central station.
- If you know the monitor will always be communicating with a specific central station, the transceiver should be assigned to the central station's current operating channel. See the ESCORT Vision Central Station Reference Manual for information on setting up the communication channel at the central station.

The following steps describe how to verify and/or change your monitor's frequency mode:

(1) Press the **NORMAL SCREEN** function key.

(2) Press the **SETUP** function key.

(3) Select **MORE** twice.

(4) Select **CONF**.

(5) Select **YES** when prompted "**ARE YOU SURE?**"

(6) Select **SETUP**.

(7) Select **YES** when prompted "**ARE YOU SURE?**"

The following menu will be displayed:

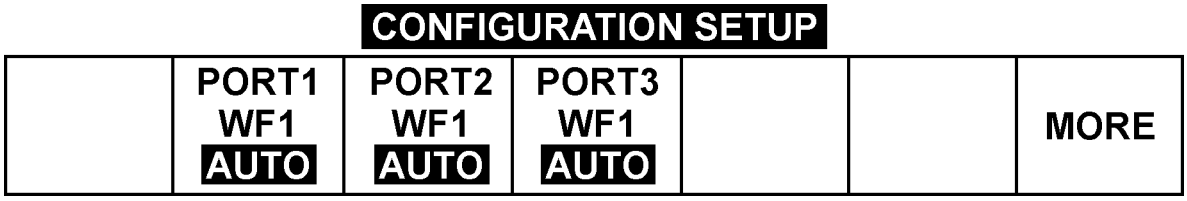


Figure 11-2. CONFIGURATION SETUP Menu 1

(8) Select **MORE** to display the following menu:

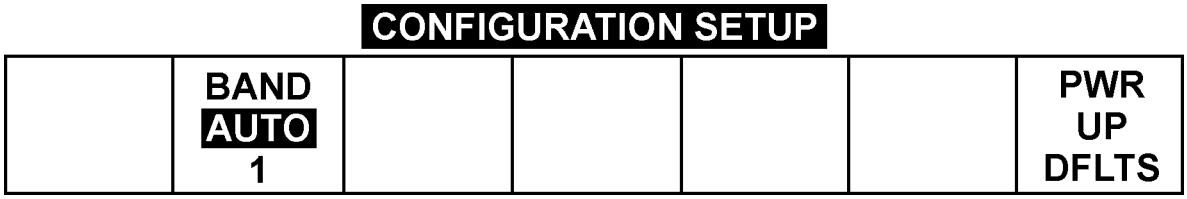


Figure 11-3. CONFIGURATION SETUP Menu 2

(9) Select **BAND** to choose channels **1 - 14** or **AUTO**.

(10) Press **NORMAL SCREEN** to return to the main monitoring screen. Changes will take effect *without* the need to cycle the monitor on and off.

(11) Allow additional time (up to approximately two minutes) to establish communications if the monitor has been set to **AUTO**.

b. **Step 2: Verify the Transceiver Communication Status.** Perform the following steps to verify acceptable communications:

(1) Press the **NORMAL SCREEN** function key.

(2) Select **MORE** twice.

(3) Select **TEST**.

(4) Select **STAT INFO** (Status Information) until **NET** is highlighted.

Figure 11-4. Test Menu

The following four items will appear on the monitor under "**NETWORK STATUS**" at the top of the screen:

- **RF TRANSPONDER:** The four-digit alphanumeric number on the far right of this line is the transceiver ID number. It identifies the transceiver connected to the monitor. If you have not installed a transceiver on the monitor or its connection with the monitor is not adequate, this line will read "**NO RF TRANSPONDER**".
- **CENTRAL TRANSPONDER:** The four-digit alphanumeric number on the far right of this line is the central station's transceiver ID number. It identifies the transceiver connected to the central station with which the monitor is currently communicating. If the monitor's frequency mode is set to **AUTO** and its transceiver is searching for a central station, but has not yet established communication, or if the monitor's transceiver ID is not associated with any central station, this line will read "**NO LINK TO CENTRAL**".
- **FREQ:** The number to the right of **FREQ** is the current monitor frequency, or operating channel. If the monitor is in **AUTO** mode, this number may change as various channels are checked; otherwise the number should not change.
- **HOPS:** The number to the right of **HOPS** indicates the number of transceivers/ repeaters this monitor's transceiver is sending data to in order to reach the central station.

NOTE

HOPS will not appear if the monitor is in AUTO mode and communications are not established with a central station.

NOTE

The *STATUS MESSAGE* area of the screen presents additional information for use by technical personnel.

11.2.3 Removing the Transceiver Module. Perform the following steps to remove the transceiver module:

a. Turn the monitor power Off by pressing the **Power Standby** key and **disconnect from AC power source**. Allow the monitor power to be Off for approximately twenty (20) seconds before proceeding with these steps.

b. Use a flat head screwdriver or 3/16"-hex nut driver to turn each of the three screws on the transceiver until the transceiver is unscrewed from the back of the monitor.

c. Unplug the transceiver from the connector on the back of the monitor.

11.3 Telemetry Module.

WARNING

The monitor power should be OFF and the power cord should be disconnected from its AC source when you attach or remove a Telemetry Module. Do not open the module. Refer all servicing to qualified technical personnel.

11.3.1 Attaching the Telemetry Module to the Monitor. Perform the following steps to attach the telemetry module to the Escort M10 monitor:

a. Turn the monitor power Off by pressing the **Power Standby** key and **disconnect from AC power source**. Proceed with the following steps after the monitor power has been turned Off for approximately twenty (20) seconds.

b. Plug the telemetry module into the **"Add-On Module Interface Connector"** on the back of the monitor, making sure to line up the three screws on the module with the three screw holes on the back of the monitor. Refer to the **"Rear Panel"** write-up in Section 2 for the location of this connector.

Depending on the monitor's configuration, the telemetry module may be connected directly to the rear panel of the ***ESCORT M10*** monitor or to other *add-on modules* (for example, a transceiver module).

c. Use a flat head screwdriver or 3/16"-hex nut driver to turn each of the three screws until the telemetry module is attached snugly to the back of the monitor/add-on module.

d. Ensure that the two telemetry antennae are BNC-mounted into place at approximately 45 degrees to the vertical, on top of the telemetry module.

e. Connect the monitor to an AC power source.

f. Turn the monitor power on by pressing the **ON** key.

11.3.2 Setting Up Telemetry Communications. The M10 Monitor can recieve ECG signals from ECG signals from either the 20012V 450 MHz receiver module or the 20012V-M6 WMTS 608-614 MHz module (depending on which reveiver is attached to the monitor). Each trasmitter is assigned a unigue ID number and is either fixed at the factory or is configurable by the user depending on the model of transmitter. The transmitter ID must be reconized by the module in order to display the patient's ECG waveform on the monitor's screen. The following procedure is to set up the telemetry communication with the monitor.

a. **Configuration.** when using the 20012V receiver module. Four different types of transmitters are available for use with the 20012V 450MHz receiver module. InvivoMDE's analog transmitters (InvivoMDE model number E12000LR), InvivoMDE's digital transmitter (InvivoMDE model number 20013), Hewlett-Packard's analog transmitters (HP model number 78100A), and InvivoMDE's ESCORT Guardian telemetry transmitter (InvivoMDE model number 20601 and 20602) can all send data to the monitor. Each of these transmitters has different capabilities. Table 11-1 presents the features of each transmitter type.

Table 11-1. Transmitter Features in the 450 MHz band

Transmitter Type	Screen Text	Pacer Detect	Remote Record	Low Battery	Check Leads	3-LEAD/- 5-LEAD	SPO2 Capability	Programable ID
InvivoMDE Digital UHF	MDD	Yes	Yes	Yes	Yes	Both	No	No
InvivoMDE Analog UHF	MDE	Yes	Yes	Yes	Yes	3-lead	No	No
HP Analog UHF	HP	No	No	No	No	3-lead	No	No
InvivoMDE Guardian UHF	GTM	Yes	Yes	Yes	Yes	Both	Yes	Yes

Three different transmitters are available for use with the 20012V-M6 WMTS 608-614MHz receiver module. InvivoMDE's Escort Guardian (InvivoMDE model number 20603), InvivoMDE's Angel (single patient use telemetry), and InvivoMDE's Angel reusable ECG only transmitter can send data into the monitor. Each of these transmitters has different capabilities. Table 11-2 presents features of each type transmitter in the WMTS 608-614 MHz band.

Table 11-2. Transmitter Features in the 608-614 MHz band

Transmitter Type	Screen Text	Pacer Detect	Remote Record	Low Battery	Check Leads	3-LEAD/- 5-LEAD	SPO2 Capability	Programable ID
Guardian 20603	GTM	Yes	Yes	Yes	Yes	Both	Yes	Yes
Angel	GTM	Yes	No	Yes	Yes	5-lead	No	Yes
Angel MP	GTM	Yes	No	Yes	Yes	Both	No	Yes

NOTE

Synchronization with an external defibrillator is not possible when an InvivoMDE Digital Transmitter is used as the source for the ECG waveform.

To access these channels, perform the following steps:

(1) Press the **NORMAL SCREEN** function key.

(2) Press the **SETUP** function key.

(3) Select **MORE** twice.

(4) Select **CONF**.

(5) Select **YES** when prompted "**ARE YOU SURE?**"

(6) Select **SETUP**.

(7) Select **YES** when prompted "**ARE YOU SURE?**"

The following menu will be displayed:

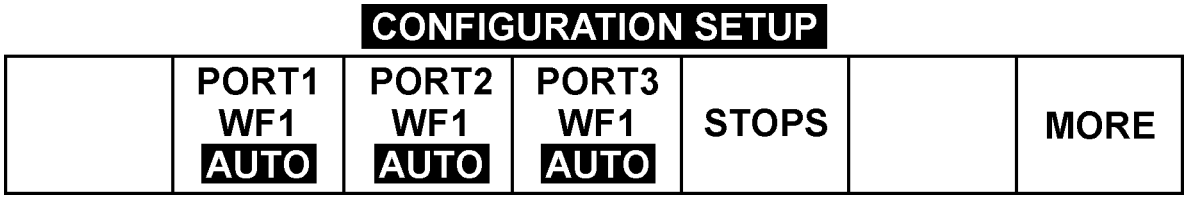


Figure 11-5. CONFIGURATION SETUP Menu 1 - with STOPS

(8) Select **STOPS**. The following menu appears:

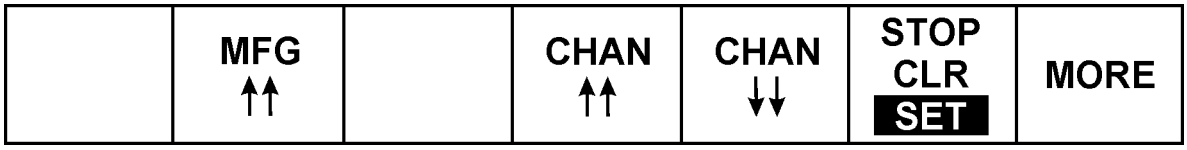


Figure 11-6. Stops Menu 1

(9) Select **MFG** ↑↑ to specify the desired transmitter type, as described in the beginning of this section. Select **CHAN** ↑↑ to specify higher channel numbers or select **CHAN** ↓↓ to specify the lower channel numbers. Select **STOP** to highlight **CLR** or **SET** channel.

NOTE

To clear all stops stored in memory, select **MORE**, then select **CLEAR ALL STOPS**. When prompted "**ARE YOU SURE?**", select **YES**. Selecting **EDIT STOPS** will revert to the previous telemetry setup page (see Figure 11-7 below).

Figure 11-7. Stops Menu 2

b. **Verify/Set the Telemetry Channel.** The following steps describe how to verify and/or change the monitor's frequency mode:

NOTE

The "telemetry-monitored" patient must be adequately prepared for proper telemetry function. Hospital personnel have the option of using either 3-lead or 5-lead monitoring depending on the type of transmitter used. In either case, proper lead attachment must be achieved with correct ECG electrodes. After the patient has been prepared, the transmitter is strapped onto the body of the patient using a transmitter pouch.

(1) Press the **NORMAL SCREEN** function key.

(2) Using the rotary knob, select the **ECG** icon.

(3) Select **MORE** twice to display the following menu:

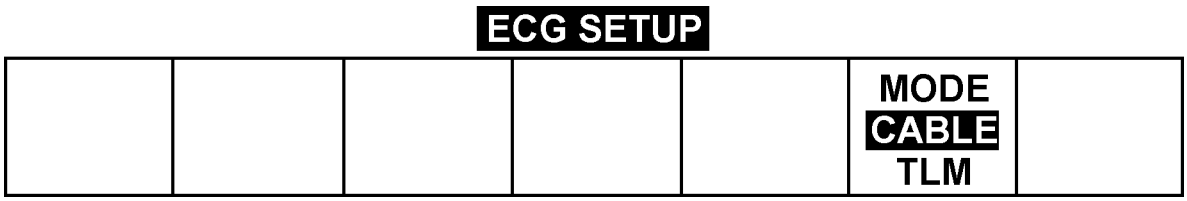


Figure 11-8. ECG SETUP Menu 3

(4) Select **MODE** until **TLM** (Telemetry) is highlighted. The following menu is displayed:

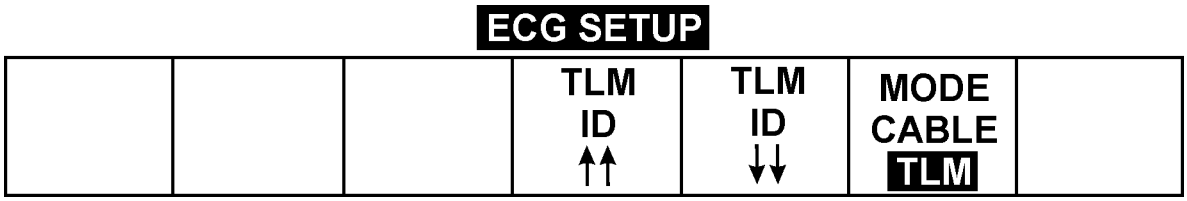


Figure 11-9. ECG SETUP Telemetry Menu

(5) Select **TLM ID** ↑↑ or **TLM ID** ↓↓ to specify the transmitter ID of the patient.

Allow a couple of seconds for each channel to settle. The ECG waveform of the patient being monitored will appear on the display together with a calculated heart rate.

The channel ID of the transmitter is displayed in the upper area of the monitor's screen, just below the **ADULT/NEO/PED** mode indication. If the receiver loses communication with the transmitter, a "**SIGNAL**" message will be displayed.

WARNING

Telemetry ID and lead selection on the monitor must be identical to that of the remote transmitter. Incorrect settings may cause the monitor to display ECG information from a different patient that is assigned to another telemetry ID number.

NOTE

The monitor will display a squelch, or triangular, waveform when excessive signal noise is present. This waveform is displayed in lieu of a noisy ECG waveform, which could cause unnecessary alarms.

NOTE

The monitor can default to **CABLE** (standard ECG cable with electrodes), **TLM** (telemetry), or **LAST** via system setup. See Section 12, "System Defaults & Messages," for details. If **LAST** is selected, the monitor will power-up to either **CABLE** or **TLM** depending on what was last used as an ECG source.

c. **Recording the Telemetry ECG Waveform.** Perform the following steps to record the telemetry ECG waveform:

(1) To record the ECG output waveform, press the push button at the top of the patient's transmitter. A pulse is sent to the telemetry module to initiate a 16-second remote recording. The time, date, transmitter ID, ECG waveform, and additional information will be printed on the recording strip.

Remote recording must first be enabled at the monitor from the **RECORDER SETUP** menu. To access the **RECORDER SETUP** menu, perform the following steps:

(1) Press the **NORMAL SCREEN** function key.

(2) Press the **SETUP** function key.

(3) Select **MORE** to display the following menu:

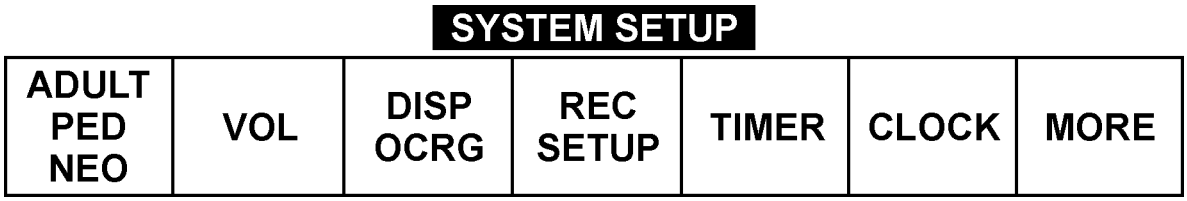


Figure 11-10. SYSTEM SETUP Menu 2

(4) Select **REC SETUP** to display the following menu:

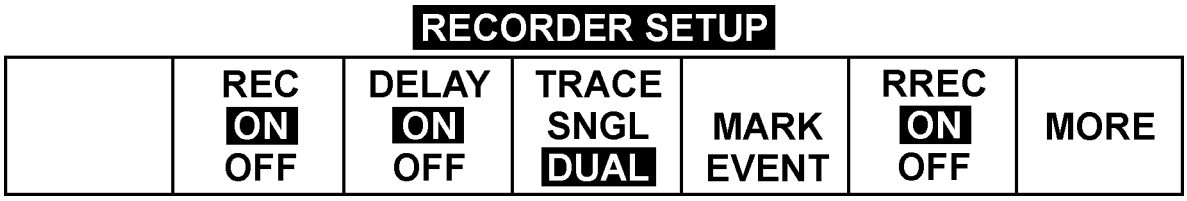


Figure 11-11. RECORDER SETUP Menu

(5) Select **RREC** to turn **ON** Remote Record. Telemetry recording will now be activated.

NOTE

The factory default for the remote record feature is set to **OFF**. The default may be configured to power up in the **ON** status. See Section 12, "System Defaults & Messages," for details on changing the power up defaults.

11.4 CIS Communication Module.

WARNING

The monitor power should be OFF and the power cord should be disconnected from its AC source when you attach or remove a CIS Module. Do not open the module. Refer all servicing to qualified technical personnel.

11.4.1 Attaching the CIS Communication Module to the Monitor. Perform the following steps to attach the CIS communication module to the Escort M10 monitor:

a. Turn the monitor power Off by pressing the **Power Standby** key and **disconnect from AC power source**. Proceed with the following steps after the monitor power has been turned off for approximately twenty (20) seconds.

b. Plug the CIS Communication Module into the "**Add-On Module Interface Connector**" on the back of the monitor, making sure to line up the three screws on the module with the three screw holes on the back of the monitor. Refer to the "**Rear Panel**" write-up in Section 2 for the location of this connector.

Depending on the monitor's configuration, the CIS module may be connected directly to the rear panel of the monitor or to other *add-on modules* (for example, a transceiver or telemetry module).

c. Use a flat head screwdriver or 3/16"-hex nut driver to turn each of the three screws until the CIS module is attached snugly to the back of the monitor/add-on module.

d. Connect the monitor to an AC power source.

e. Turn the monitor power On by pressing the **ON** key.

11.4.2 Setting Up CIS Communication Module Operation. For complete information on configuring and operating the CIS interface module, refer to the **Clinical Information System (CIS) Communication Module Operator's Manual** and the **Clinical Information System (CIS) Communication Module Configuration Instructions**, or contact InvivoMDE Technical Support at (888) 221-1593 / (818) 768-6411.

SECTION 12
SYSTEM DEFAULTS & MESSAGES

12.0 SYSTEM DEFAULTS & MESSAGES.

12.1 Default Settings. When the Escort M10 Vital Signs Monitor is powered on for the first time, it will be in the Neonatal mode, and all parameters will be set to their factory defaults.

Each parameter has defaults for adult, pediatric, and neonatal modes (ADULT, PED, NEO). All parameter and system defaults can be user-configured.

It is important to recognize that changes made to these functions determine the status of those functions upon every subsequent power-up. As a result, default settings should not be changed unless the setting will be required on a regular basis.

Should it become necessary to change your system defaults, Tables 12-1 through 12-14 can be copied and used to conveniently record the new default settings for future reference.

Configuring your own defaults is discussed later in this section under the heading "**Changing Parameter and System Defaults**".

Table 12-1. System Setup Default Record

System Setup	Adult	Pediatric	Neonatal	Description
FACTORY DEFAULTS				To restore all settings to factory defaults.
PWR DN MEMORY				Selected time for saving VSC settings
ALRM VOLUME				Alarm tone volume setting (1-8)
ALM VOL MIN				Sets minimum allowable alarm tone volume setting (1-8)
TONE VOLUME				Key tone setting
TRACE 2				Waveform or feature for second trace
TRACE 3				Waveform or feature for third trace
TRACE 4				Waveform or feature for fourth trace
HR SOURCE				Heart rate source, ECG, SPO2, BP's
ALM SUSPND				Alarm suspend time
PRAM LABELS				To blank parameters when off
CLOCK DISPLY				Time displayed on screen
CABLE / TELM				ECG mode - telemetry or cable
REMOTE RECD				Telemetry recording
ALARM FLASH				Flashing alarm LED
LANGUAGE				Sets language (English, French, German, Spanish, Swedish, or Italian)
LINE FREQ				50Hz or 60Hz input line frequency
PATIENT TYPE				ADULT, PED, NEO, or ALL
ALARM CNTRL				When default is set to ON, allows enabled alarms to be turned OFF

Table 12-2. Recorder Default Record

Recorder Setup	Adult	Pediatric	Neonatal	Description
RECD DELAY				Four second delay
ALRM RECDNG				Alarm recording enable/disable
DUAL RECDNG				Dual trace recording
REMOTE RECD				Telemetry recording

Table 12-3. Vital Signs Chart Default Record

VSC Setup	Adult	Pediatric	Neonatal	Description
STORE AUTO				Auto stores at selected intervals
STORE NIBP				Storing NIBP values
STORE TMP				Storing Temperature values
STORE CO				Storing Cardiac Output values
VALID TIME				Displayed time for NIBP, Suretemp, and CO
STORE ALARM				Storing alarm violations
STR ECG ALM				Storing ECG alarm violations
STR SPO2 ALM				Storing SPO2 alarm violations
STR RESP ALM				Storing Respiration alarm violations
STR CO2 ALM				Storing CO2 alarm violations
STR BP ALM				Storing IBP alarm violations
STR NIBP ALM				Storing NIBP alarm violations
STR TMP ALM				Storing temperature alarm violations

Table 12-4. ECG Setup Default Record

ECG Setup	Adult	Pediatric	Neonatal	Description
ALARMS				Enables ECG alarms
ALARM LEVEL				Sets alarm priority level (1, 2, or 3)
LATCH ALARMS				Latches the ECG alarms until reset
HIGH LIMIT				High alarm limit setting
LOW LIMIT				Low alarm limit setting
RCD ON ALARM				Record when ECG alarm enabled
FILTER				ECG filter enable
SIZE VCTR 1				3 lead select size
SIZE VCTR 2				5 lead select size
SWEEP SPEED				Waveform speed
PACE DETECT				Pacer detection enable
LEAD SELECT				Lead select I, II, III, or V
5 LEAD				5 lead mode enable
QRS TONE				QRS detect tone
WAVEFORM ON				ECG waveform enable
PRAM COLOR				Sets on-screen color of parameter

Table 12-5. Respiration Setup Default Record

Respiration Setup	Adult	Pediatric	Neonatal	Description
ALARMS				Enables respiration alarm
ALARM LEVEL				Sets alarm priority level (1, 2, or 3)
LATCH ALARMS				Latches the Respiration alarms until reset
HIGH LIMIT				High alarm limit setting
LOW LIMIT				Low alarm limit setting
PRAM AVAIL				Respiration enable or disable
PRAM ON/OFF				Respiration standby
RCD ON ALARM				Record when Resp alarm enabled
RESP SIZE				Respiration waveform size
SWEEP SPEED				Respiration waveform speed
APNEA DELAY				Time delay for apnea alarm
APNEA ALM LVL				Sets alarm priority level (1, 2, or 3)
CVA				Artifact detection
TONE				Respiration Rate tone
CRG SCALES				OXYCRG scales enable
PRAM COLOR				Sets on-screen color of parameter

Table 12-6. SPO2 Setup Default Record

SPO2 Setup	Adult	Pediatric	Neonatal	Description
ALARMS				Enables SPO2 alarm
ALARM LEVEL				Sets alarm priority level (1, 2, or 3)
ALARM DELAY				Delay time for alarm
LATCH ALARMS				Latches the SPO2 alarm until reset
ALARM TONE				Tone during alarm
HIGH LIMIT				High alarm limit setting
LOW LIMIT				Low alarm limit setting
PRAM AVAIL				SPO2 enable or disable
PRAM ON / OFF				SPO2 standby
RCD ON ALARM				Record when SPO2 alarm enabled
TONE				Tone enable for SPO2
TONE RANGE				SPO2 tone frequency range
MODE				SPO2 averaging time
C-LOCK				ECG synchronization
WAVEFORM ON				SPO2 waveform enable
PRAM COLOR				Sets on-screen color of parameter

Table 12-7. BP1 Setup Default Record

BP1 Setup	Adult	Pediatric	Neonatal	Description
ALARMS				Enables BP1 alarm
ALARM LEVEL				Sets alarm priority level (1, 2, or 3)
LATCH ALARMS				Latches the BP1 alarm until reset
SYS HI LIMIT				Systolic high alarm limit setting
SYS LO LIMIT				Systolic low alarm limit setting
DIA HI LIMIT				Diastolic high alarm limit setting
DIA LO LIMIT				Diastolic low alarm limit setting
MN HI LIMIT				Mean high alarm limit setting
MN LO LIMIT				Mean low alarm limit setting
PRAM AVAIL				BP1 enable or disable
PRAM ON / OFF				BP1 standby
RCD ON ALARM				Record when BP1 alarm enabled
SIZE				BP1 waveform size
SCALE				BP1 scale enable
DISPD VALUES				BP1 numeric display format
SITE				BP1 catheter site
PRAM COLOR				Sets on-screen color of parameter

Table 12-8. BP2 Setup Default Record

BP2 Setup	Adult	Pediatric	Neonatal	Description
ALARMS				Enables BP2 alarm
ALARM LEVEL				Sets alarm priority level (1, 2, or 3)
LATCH ALARMS				Latches the BP2 alarm until reset
SYS HI LIMIT				Systolic high alarm limit setting
SYS LO LIMIT				Systolic low alarm limit setting
DIA HI LIMIT				Diastolic high alarm limit setting
DIA LO LIMIT				Diastolic low alarm limit setting
MN HI LIMIT				Mean high alarm limit setting
MN LO LIMIT				Mean low alarm limit setting
PRAM AVAIL				BP2 enable or disable
PRAM ON / OFF				BP2standby
RCD ON ALARM				Record when BP2 alarm enabled
SIZE				BP2 waveform size
SCALE				BP2 scale enable
DISPD VALUES				BP2 numeric display format
SITE				BP2 catheter site
PRAM COLOR				Sets on-screen color of parameter

Table 12-9. BP3 Setup Default Record

BP2 Setup	Adult	Pediatric	Neonatal	Description
ALARMS				Enables BP3 alarm
ALARM LEVEL				Sets alarm priority level (1, 2, or 3)
LATCH ALARMS				Latches the BP2 alarm until reset
SYS HI LIMIT				Systolic high alarm limit setting
SYS LO LIMIT				Systolic low alarm limit setting
DIA HI LIMIT				Diastolic high alarm limit setting
DIA LO LIMIT				Diastolic low alarm limit setting
MN HI LIMIT				Mean high alarm limit setting
MN LO LIMIT				Mean low alarm limit setting
PRAM AVAIL				BP3 enable or disable
PRAM ON / OFF				BP3 standby
RCD ON ALARM				Record when BP3 alarm enabled
SIZE				BP3 waveform size
SCALE				BP3 scale enable
DISPD VALUES				BP3 numeric display format
SITE				BP3 catheter site
PRAM COLOR				Sets on-screen color of parameter

Table 12-10. NIBP Setup Default Record

NIBP Setup	Adult	Pediatric	Neonatal	Description
ALARMS				Enables NIBP alarm
ALARM LEVEL				Sets alarm priority level (1, 2, or 3)
LATCH ALARMS				Latches the BP2 alarm until reset
SYS HI LIMIT				Systolic high alarm limit setting
SYS LO LIMIT				Systolic low alarm limit setting
DIA HI LIMIT				Diastolic high alarm limit setting
DIA LO LIMIT				Diastolic low alarm limit setting
MN HI LIMIT				Mean high alarm limit setting
MN LO LIMIT				Mean low alarm limit setting
PRAM AVAIL				NIBP enable or disable
PRAM ON / OFF				NIBP standby
RCD ON ALARM				Record when NIBP alarm enabled
AUTO				Automatic mode enable
INTERVAL				Automatic reading interval
1ST INFLATE				First inflation pressure
TABLE DSPLY				Enables NIBP table display
DISPD VALUES				NIBP numeric display format
TONE				Enables end value tone
SITE				NIBP cuff site
PRAM COLOR				Sets on-screen color of parameter

Table 12-11. Temperature 1 Setup Default Record

Temperature 1 Setup	Adult	Pediatric	Neonatal	Description
ALARMS				Enables Temp1 alarm
ALARM LEVEL				Sets alarm priority level (1, 2, or 3)
LATCH ALARMS				Latches the Temp1 alarm until reset
UNITS				Celsius or Fahrenheit
HIGH LIMIT				High alarm limit setting
LOW LIMIT				Low alarm limit setting
PRAM AVAIL				Temp1 enable or disable
PRAM ON/OFF				Temp1 standby
TONE				Measurement update tone enable
PRAM COLOR				Sets on-screen color of parameter

Table 12-12. Temperature 2 Setup Default Record

Temperature 2 Setup	Adult	Pediatric	Neonatal	Description
ALARMS				Enables Temp2 alarm
ALARM LEVEL				Sets alarm priority level (1, 2, or 3)
LATCH ALARMS				Latches the Temp1 alarm until reset
HIGH LIMIT				High alarm limit setting
LOW LIMIT				Low alarm limit setting
PRAM AVAIL				Temp2 enable or disable
PRAM ON/OFF				Temp2 standby
PRAM COLOR				Sets on-screen color of parameter

Table 12-13. CO2 Setup Default Record

CO2 Setup	Adult	Pediatric	Neonatal	Description
ALARMS				Enables CO2 alarm
ALARM LEVEL				Sets alarm priority level (1, 2, or 3)
LATCH ALARMS				Latches the CO2 alarm until reset
HIGH LIMIT				High alarm limit setting
LOW LIMIT				Low alarm limit setting
ICO2 LIMIT				Inspired CO2 alarm limit setting
PRAM AVAIL				CO2 enable or disable
PRAM ON/OFF				CO2 standby
RCD ON ALARM				Record when CO2 alarm enabled
SCALE				CO2 waveform scale size
UNITS				Measurement units % or mmHg
O2 COMPNSAT				O2 compensation enable
N2O COMPNSAT				N2O compensation enable
PRAM COLOR				Sets on-screen color of parameter

Table 12-14. CO Setup Default Record

CO Setup	Adult	Pediatric	Neonatal	Description
PRAM AVAIL	ON	ON	ON	Cardiac output enable or disable
CONSTANT	.470	.470	.470	Adjusts computational constant for catheter and injectate volume
PRAM ON/OFF	OFF	OFF	OFF	Cardiac output standby
REF ON/OFF	ON	ON	ON	Right ejection fraction measurement enable
DISP TIMEOUT	5	5	5	Displayed time for CO measurement
UNITS	IN/LB	IN/LB	IN/LB	Inches/pounds or centimeters/kilograms
PRAM COLOR	PINK	PINK	PINK	Sets on-screen color of parameter

12.2 Changing the Parameter and System Defaults. The Escort M10 monitor allows you to tailor the parameter and system default settings to suit your specific monitoring needs. It is important to recognize that changes made to these functions determine the status of those functions upon every subsequent power-up. As a result, default settings should not be changed unless the setting will be desired on a regular basis.

Perform the following steps to access the **CONFIGURATION SETUP** menus and screens:

(1) Press the **NORMAL SCREEN** function key.

(2) Press the **SETUP** function key.

(3) Select **MORE** twice.

(4) Select **CONF**.

(5) Select **YES** when prompted "**ARE YOU SURE?**"

(6) Select **SETUP**.

(7) Select **YES** when prompted "**ARE YOU SURE?**"

(8) The CONFIGURATION SETUP Menu 1 (see Section 11, Figure 11-2) will be displayed.

(9) Select **MORE** to display the CONFIGURATION SETUP Menu 2 (see Section 11, Figure 11-3)

(10) Select **PWR UP DFLTS** to display the following menu:

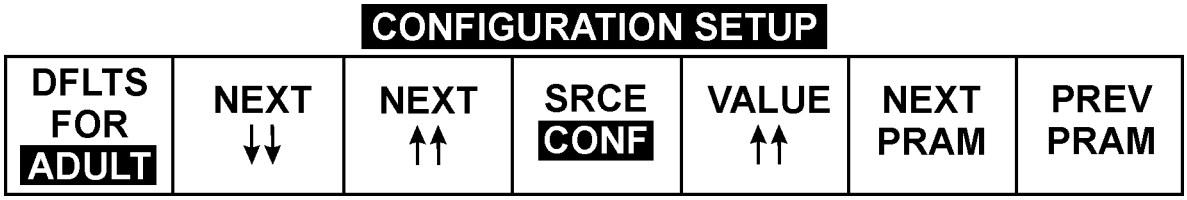


Figure 12-1. CONFIGURATION SETUP Power Up Defaults Menu

This menu contains options that can be used to modify the factory defaults to a user-defined configuration. Each of the available options is explained in the following paragraphs.

- Select **DFLTS** to set the defaults for **ADULT, PED,** or **NEO**.
- Select **NEXT** ↓↓ and **NEXT** ↑↑ to move vertically through the list of default functions listed on the monitor until you have highlighted the function you want to change.
- **SRCE** (Source) toggles between **FACT** (Factory) and **CONF** (user-configured) values for each default function. Selecting **VALUE** ↑↑ for any function which, currently has a factory setting, will automatically change the **SRCE** option from **FACT** to **CONF**. The **SRCE** option is especially useful for returning any functions currently with a user-configured value back to the factory default; simply select **SRCE** to toggle the **SRCE** option to **FACT**, and the configured default value will return to the factory default setting.
- Select **VALUE** ↑↑ to change the setting of the highlighted parameter function. The **VALUE** ↑↑option toggles between two possible settings, such as **ON/OFF**, or adjusts a numeric value. Once a numeric value reaches its maximum value, the setting rolls over to start at the minimum level.

NOTE

The display of the configuration pages will time-out and return you to the Normal Screen if you do not use a function key within a three minute interval. If you have completed your default changes and want to return to the Normal Screen, press the **NORMAL SCREEN** key. All changes will take affect upon return to the Normal Screen.

12.3 System, Battery and Parameter Messages. System, battery and parameter messages remind, prompt, or warn you about the current condition of the monitor or its parameters. These messages are displayed in reverse video and may flash on and off to get your attention.

12.3.1 System Messages. The system messages, explained in Table 12-15, are displayed in a reverse-video box, just below the WDZ. They apply to conditions of the monitor that are not specific to any one parameter. (See the **"System Message Area"** write-up in Section 2 for more information.)

Table 12-15. System Messages

System Message	Meaning
RECORDER PAPER	The recorder is out of paper, or the paper is not installed correctly
REC DISABLE FREEZE	You are trying to freeze waveforms while recording is in progress. You can only freeze waveforms when they are not being recorded.
REC IN CONT RUN MODE	Indicates that you have pressed and held the RECORD key so that the recorder will run continuously. Press RECORD again to end continuous recording.
FREZ RELEASE FREZ	Waveforms are currently frozen. To release the frozen waveforms, you must press either the FREEZE or the RECORD key.
LINK RECORD SENT	A record has been sent to the Central Station because the recorder at PRISM SE monitor is either not present or out of paper.
ALARM SUSPEND XXX	You have pressed the ALARM SUSPEND key, disabling all alarm tones for the number of seconds (XXX) displayed. To enable alarm tones before the suspend time has expired, press the ALARM SUSPEND key again. The ALARM SUSPEND function is also enabled at power-up.

12.3.2 Battery Messages. When the monitor is operating on battery power, one of the following messages will be temporarily displayed on the system message line when the monitor is turned **ON**. Battery messages may also be viewed within the **SYSTEM SETUP/TEST** menu. (See the **"Battery Check"** write-up in Section 9 for details.)

Table 12-16. Battery Messages

Battery Message	Meaning
MONITOR BAT HI	> 60% Charge
MONITOR BAT MID	20-60% Charge
MONITOR BAT LOW	< 20% Charge
BATTERY VERY LOW (Intermittent Alarm Tone Sounds)	Approximately 10 minutes of battery life remains

12.3.3 Parameter Messages. The following tables explain messages that are parameter specific. Messages concerning parameters displayed in the WDZ will be displayed in a video box below the numeric data for the corresponding waveform parameters. The message is displayed as long as the message condition exists. All messages that apply to parameters in the numeric-only zone are displayed in the numeric display area. (See Section 2 for details.)

Table 12-17. ECG Messages

ECG Message	Meaning
CVA	Cardiovascular artifact (CVA) coincidence has been detected on respiration. Respiration will reject coincident respiration while the message is displayed. At least 8 out of 10 coincident respirations are required to initiate and maintain the CVA message.
APNEA	The apnea alarm limits have been exceeded.
APN ALM OFF	Respiration alarms are ON, but apnea alarm is OFF.
CHK LEADS	One or more electrodes or lead wires may be dry or loose. In addition to the message, the ECG waveform and respiration waveform, if it is displayed, become dotted lines.

Table 12-18. SPO2 Messages

SPO2 Message	Meaning
SPO2 SRCH (Nellcor only)	The monitor cannot locate the patient's pulse. The patient's perfusion may be too poor to detect an acceptable pulse. Confirm proper application of the sensor; make sure the ECG parameter is available for C-LOCK synchronization; try another sensor site; or try the OXISENSOR II R-15 sensor.
NO C-LOCK (Nellcor only)	Indicates loss of synchronization between the ECG and SPO2 pulse waveform. Take steps to eliminate ECG artifact, or if the R-wave amplitude is less than 4 mm, increase the ECG waveform size by using the ECG SIZE menu option.
NO SENSOR	The SPO2 parameter is ON, but the sensor and/or sensor cable is/are not connected to the monitor.
SPO2 CAL	The monitor is performing automatic self-calibration. The calibration range is 50 to 100%.

Table 12-19. Invasive Blood Pressure (BP1, BP2, BP3) Messages

IPB Message	Meaning
NO XDUCER	The pressure transducer is not connected to the monitor.
ZERO BP1 **ZERO BP2** **ZERO BP3**	Message flashes until the pressure channel is zeroed as a reminder that pressures must be zeroed prior to use.
NO ZERO: PULSE DETECT	Displayed over the BP SETUP page to indicate that either a pulse or electrical noise was detected, which precluded zeroing the transducer. Confirm that the transducer is vented to air before pressing the ZERO key.
ZERO OUT OF RANGE	Displayed over the BP SETUP page to indicate that a transducer's offset exceeds the zero range (±100 mmHg) of the monitor. Confirm that the transducer is vented to the air and attempt to zero again.

Table 12-20. Noninvasive Blood Pressure (NIBP) Messages

NIBP Message	Meaning
ET = MM:SS	Indicates elapsed time (ET) since last NIBP measurement.
AET = MM:SS	Indicates elapsed time since last NIBP measurement while auto timer is on.
AUTO	Monitor is in NIBP AUTO mode.
CUFF = XXX	Displays as the cuff inflates and deflates, giving the pressure in mmHg.
LOW OSCIL	Oscillation amplitudes are too low to obtain measurement.
ARTIFACT	Excessive artifact precluded measurement within a 145-second time-out.
MAX 2 LOW	Cuff inflation was too low to take a reading. May indicate either incorrect operating mode (ADULT, PED, NEO) or a need to increase the initial inflation.
CHECK CUF	40-second time-out exceeded for inflation to at least 20 mmHg.

Table 12-21. ETCO2 Messages

ETCO2 Message	Meaning
NO SENSOR	The MediCO2 module has detected that NO Filter Line is currently connected. This message will remain displayed until a Filter Line is connected or another CO2 status message is displayed.
WARM UP	This message is displayed for approximately 5-10 seconds after the installation of the Filter Line, or after power-up with the Filter Line already installed.
FILT OCCL	The MediCO2 module has detected an airway blockage. If blockage remains for more than 30 seconds, the MediCO2 module will go into standby mode and this message will remain displayed until Filter Line is disconnected.
CO2 ERROR	This message will be displayed if the CO/CO2 firmware has not received valid data from the MediCO2 module for more than 30 seconds.
ICO2	This message will be displayed when the INSPIRED CO2 value has exceeded the alarm limit set in the CO2 Setup page in deep configuration or in the Alarm Limits page under the CO2 Parameter menu.

Table 12-22. SureTemp Messages

SureTemp Message	Meaning
T1 INITIAL	This message is displayed for a few moments as the probe warms up.
T1 WAIT	This message displays momentarily when the probe is removed from the well.
T1 READY	This message means it is time to insert the probe (orally or rectally).
T1 FINAL	This message displays when the final temperature is reached.

Table 12-22. SureTemp Messages (Continued)

SureTemp Message	Meaning
T1 POSITN	If a "t1 POSITN" error displays during the reading, reposition the probe, and initiate a new measurement.
T1 MONITOR	Displays when taking a patient's axillary temperature.

Table 12-23. Cardiac Output (CO) Messages

CO Message	Meaning
NO CATH	No catheter connected to the monitor.
NO PROBE	No temperature probe (bath or injectate) connected to the monitor.
∧ ∧ **RANGE** ∧ ∧	Signal over range.
∨ ∨ **RANGE** ∨ ∨	Signal under range.
<< RANGE >>	Cardiac output out of range.
BASELINE	Noisy baseline detected.
IRG CURVE	Irregular curve detected.
PEAKS	Multiple curve peaks detected.
INJ LATE	Delayed injection detected.
DRIFT	Excessive thermal drift detected.
SHORT CUR	Short thermodilution curve detected.
LONG CURV	Long thermodilution curve detected.
WARM H2O	Warm H2O for injectate or bath detected.
NO ECG	No ECG signal detected by the monitor.
<<EF HR>>	REF HR out of range.
IRG ECG	Irregular rhythm.
<<CO EF>>	REF out of range.
FAST DRO	Fast drop curve.
EF EARLY	Premature beat.
EF LATE	Delayed beat.
<<BOLUS>>	REF post bolus out of range.
RUNS FULL	Maximum number of runs performed.
DELETED	Measurement run deleted.

SECTION 13
TROUBLESHOOTING

13.0 TROUBLESHOOTING.

13.1 Overview. InvivoMDE provides 24-hour technical support and should be contacted if a problem persists after consulting the following troubleshooting guidelines. An InvivoMDE Technical Support Specialist will be able to provide additional help in determining system problems, and, if necessary, supplying shipping instructions should the equipment need to be returned to the factory. All returned equipment must be issued a Return Material Authorization Number (RMA #) prior to shipment. An RMA number may be obtained from InvivoMDE Technical Support.

To contact InvivoMDE Technical Support, call: (888) 221-1593 / (818) 768-6411.

Table 13-1. General Solutions

Problem	Possible Causes	Action/Solution
Monitor does not turn on.	AC power may not be connected.	Verify that AC ON light is on.
Parameter labels display, but without alarm status or data.	Parameter sensor or cable is not connected to monitor.	Connect appropriate sensor or cable to the monitor.
Parameter does not display label or data.	Parameter is “not available” in power-up defaults.	Contact service personnel to change power-up status.
Parameter does not display label or data.	Parameter sensor or cable is not connected to monitor.	Connect appropriate sensor or cable to the monitor.

Table 13-2. ECG Solutions

Problem	Possible Causes	Action/Solution
CHK LEADS message.	Electrodes may not be conductive enough to provide signal.	Confirm electrode placement and skin preparation and adhesion.
	The LEAD SEL option may be set incorrectly (3-lead or 5-lead).	Verify that LEAD SEL is set for correct lead configuration.
	ECG patient leads and/or cable are not connected.	Confirm connections at lead block and at the monitor.
CHK LEADS message is displayed with ECG waveform.	Lead I, II, or III is being monitored with 5-lead cable installed and selected. One or more leads that are not used for ECG waveform is disconnected (e.g. Lead II is being monitored and LA is disconnected.	Confirm electrode placement and skin preparation, confirm leads are connected at lead block, and make sure cable is connected to monitor. If possible, use a 3-lead cable when monitoring Leads I, II, or III.

Table 13-2. ECG Solutions (Continued)

Problem	Possible Causes	Action/Solution
Displayed heart rate is too low.	Insufficient R-wave amplitude.	Use ECG SIZE to increase waveform size. Select an ECG vector that provides an R-wave amplitude at least twice that of the T and P-wave.
Displayed heart rate is too high.	The amplitude of the ECG waveform is too high.	Use the ECG SIZE function to decrease waveform size.

Table 13-3. Respiration Solutions

Problem	Possible Causes	Action/Solution
Erratic Respiration rate and waveform.	Poor electrode placement or conductivity.	Confirm proper electrode placement and adhesion.
Respiration rate displayed is less than actual rate.	Respiration waveform amplitude is too low.	Use RESP SIZE function to increase waveform amplitude.
Respiration rate displayed is higher than actual rate.	Cardiovascular artifact (CVA) is interfering with signal.	Reposition the LA electrode to reduce CVA.

Table 13-4. SPO2 Solutions with Nellcor

Problem	Possible Causes	Action/Solution
Pleth waveform does not track pulse; SPO2 SRCH is displayed, or oxygen saturation does not display.	Sensor is not applied correctly. Sensor or cable is damaged. Patient's perfusion is too poor for oximeter to detect a pulse. Excessive patient motion.	Check sensor application. Verify red light on sensor illuminates. Replace cable if needed. Try another sensor site. Reduce patient motion or set response mode to SLOW.
NO C-LOCK message displays.	Poor patient perfusion. ECG electrode or lead is loose.	Try another sensor site. Check all ECG connections.
NO SENSOR is displayed.	Sensor not connected. Damaged Sensor or cable. Unknown sensor connected.	Check sensor connections. Verify red light on sensor illuminates. Replace cable if necessary. Replace with Nellcor sensor.
LOW SIG is displayed.	Sensor off patient.	Place sensor on patient.
ARTIFACT is displayed.	Excessive patient motion.	Reduce patient motion.
O2 WRT ER	May indicate an older version of main software and **SLOW** mode is selected.	Select either **NORM** or **FAST** mode.

Table 13-5. SPO2 Solutions with Masimo

Problem	Possible Causes	Action/Solution
Pleth waveform does not track pulse; SPO2 SRCH is displayed, or oxygen saturation does not display.	Sensor is not applied correctly. Sensor or cable is damaged. Patient's perfusion is too poor for oximeter to detect a pulse. Excessive patient motion. Environmental interference.	Check sensor application. Verify red light on sensor illuminates. Replace cable if needed. Try another sensor site. Reduce patient motion. Move away from light or noise source.
No SENSOR is displayed.	Sensor is not connected. Sensor or cable is damaged. Unknown sensor connected.	Check sensor connections. Verify red light on sensor illuminates. Replace cable if necessary. Replace with Masimo sensor.
All other messages.		Contact Invivo)MDE Technical Support.

Table 13-6. SureTemp Solutions

Problem	Possible Causes	Action/Solution
T1 Position message.	Incorrect probe placement.	Check location of probe to ensure monitor is set for position used. For example, axillary, oral, or rectal.
Unit never displays T1 Ready.	Probe switch failure. Probe not attached properly. Probe never inserted into well. Defective probe. Defective cable.	Check/Replace probe switch. Reattach probe properly. Insert the probe into the well. Replace the probe. Replace cable.
Unit constantly displays T1 initial.	Defective probe.	Check/Replace the probe.
Suspected inaccurate reading.	Incorrect probe covers. T1 not ready. Technique.	Ensure Welch Allyn probe covers are used. Ready message not displayed before attempted temperature. Ensure good clinical technique. For example, sublingual pocket w/oral reading.
T1 Error message.	Defective probe. Loss of communication.	Check/Replace the probe. Check/Replace SureTemp board.

Table 13-6. SureTemp Solutions (Continued)

Problem	Possible Causes	Action/Solution
Unit switches from predictive to monitor mode automatically.	Ambient temperature above 90° F.	Relocate/Reposition unit.
	Patient temperature outside predictive temperature range.	Use MONITOR mode for temperature measurement.

Table 13-7. CO2 Solutions

Problem	Possible Causes	Action/Solution
No Sensor message.	No filter line is connected.	Connect a filter line to the monitor.
Filt Occl message.	Filter occluded/airway blockage detected.	Remove/Replace the filter line.
CO2 Error.	Digital error.	Check/Replace CO2, CO/CO2 board and CO2 module.

Table 13-8. Invasive Blood Pressure (IBP) Solutions

Problem	Possible Causes	Action/Solution
Will not zero - ZERO OUT OF RANGE displays.	Faulty transducer or transducer is not zeroed.	Try new transducer or rezero current one.
Will not zero - NO ZERO: PULSE DETECT displays.	The monitor has detected a pulse.	Open the stopcock on transducer to air and rezero.
Pressure values are lower than expected.	Dampened waveform from bubbles in the line.	Flush the line.
	Transducer was repositioned after zeroing was completed.	Rezero the transducer.
Pressure values are higher than expected.	Excessive tubing length is causing resonance.	If possible, reduce length of tubing and rezero transducer.

Table 13-9. Noninvasive Blood Pressure (NIBP) Solutions

Problem	Possible Causes	Action/Solution
CHECK CUFF message displays.	Poor connection to monitor or cuff.	Verify that NIBP assembly is connected to the monitor.
	Cuff or hose assembly is leaking.	Check cuff and hose for leaks.
	Cuff is loose on the patient.	Make sure cuff is correct size and snug on patient.
ARTIFACT message displays.	Too much patient movement.	If possible, reduce patient movement and retake reading.

Table 13-9. Noninvasive Blood Pressure (NIBP) Solutions (Continued)

Problem	Possible Causes	Action/Solution
LOW OSCIL message displays.	Pulse detected is too low due to improper placement or tightness of cuff.	Make sure cuff is positioned correctly and snug on patient.
NIBP pump turns on and off during inflation.	Monitor is set to PED or NEO mode.	If monitoring an adult patient, switch to ADULT mode, otherwise this behavior is acceptable.
Inaccurate NIBP readings.	Improper cuff placement.	Ensure proper cuff placement.
MAX 2 LOW message displays.	Monitor did not obtain valid systolic reading.	Retry reading. Note: subsequent inflations are 25 mmHg higher.

Table 13-10. Recorder Solutions

Problem	Possible Causes	Action/Solution
Paper jams.	Improper paper or an obstruction in paper exit area.	Confirm proper paper is installed (blank thermal paper, 50 mm wide roll up to 2 in. in diameter). Remove paper and clear paper path. Reinstall paper and retry.
No recording prints on paper.	Paper is not installed properly.	Ensure that paper is properly installed. Confirm correct paper is being used.

Table 13-11. Battery Solutions

Action	Possible Causes	Action/Solution
Battery cycle time is less than expected.	Battery not adequately charged. Battery is old or damaged.	Verify battery is at least 90% charged. Replace battery.
Battery will not charge and Battery Charging indicator is OFF.	AC power is not connected properly. Battery installed incorrectly. battery is old or damaged.	Confirm that front panel AC ON indicator is on. Ensure that the ESCORT M10 is connected to AC power. Install battery correctly. Replace battery.

TROUBLESHOOTING FLOWCHART

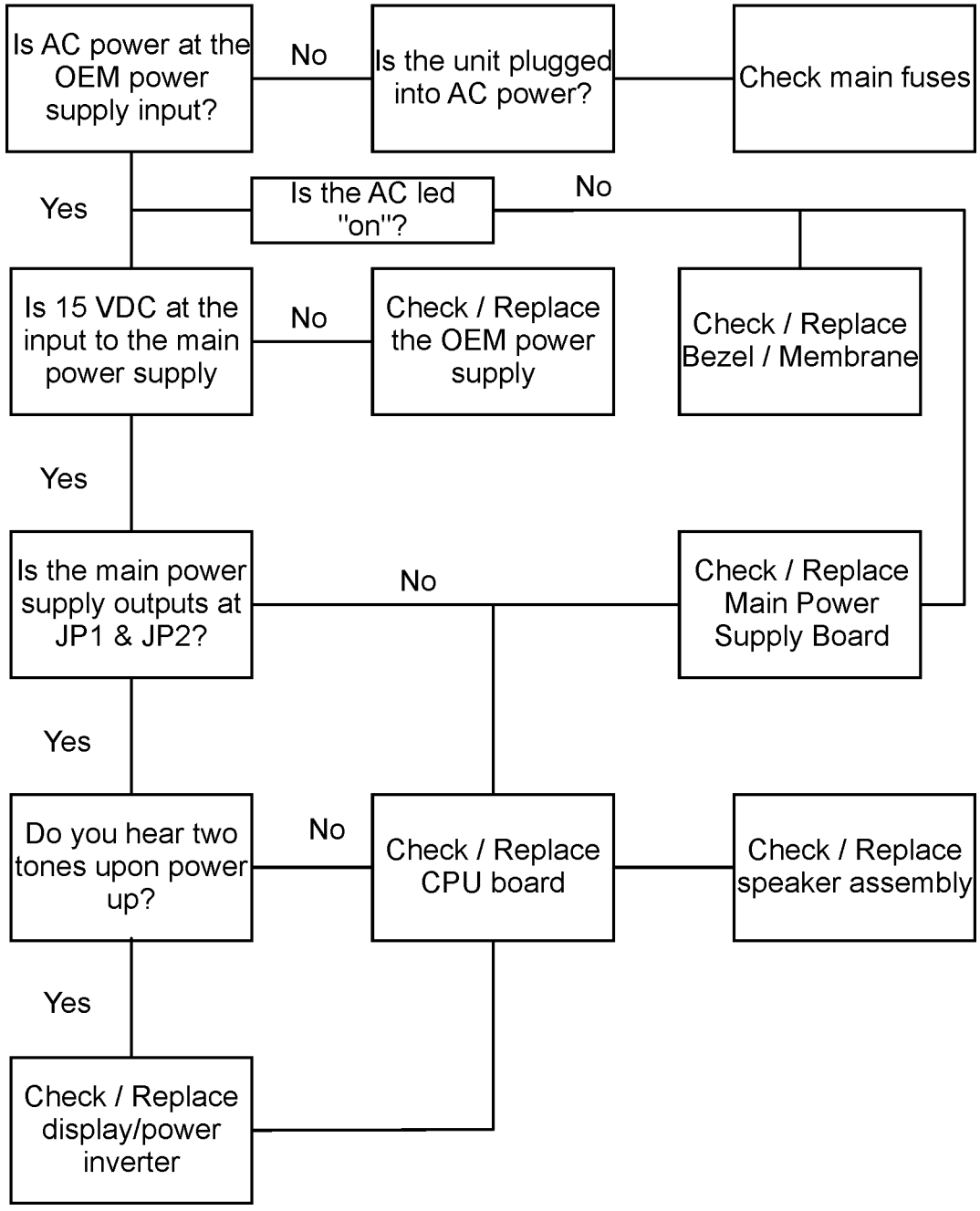


Figure 13-1. Troubleshooting Flowchart

APPENDIX A
SPECIFICATIONS

A.0 SPECIFICATIONS.

General	
Patient Safety	
Designed to meet the requirements of the following certifications: CSA601.1, IEC 60601-1, IEC 60601-2, UL544, CE/MDD, FCC Part 90.217 (UHF), FCC Part 15 (Spread Spectrum), ETS 300328.	
Power Requirements	
AC Operating Voltages	115/230VAC autosensing.
Frequency	50 to 60 Hz selectable.
External DC In	12 to 28VDC, 3A max – charge batteries.
Power Consumption	27 W.
Battery	
Type	AH Rechargeable Sealed Lead Acid
Operation Time	3.5 hrs maximum
Environment	
Operating Temperature	5 to 40° C
Storage Conditions	Temperature: -10° C to 40° C Humidity: 0 to 90%. Pressure: 500 to 1060 hpa.
Relative Humidity	0 to 90% noncondensing
Dimensions	
Height	8.9 inches (22.6 cm).
Width	12.3 inches (31.2 cm).
Depth	8.3 inches (21.1 cm).
Weight	10.5 lb (4.8 kg), includes one battery pack.
Display	
Type	Color Active Matrix TFT LCD.
Screen Size	10.4 inch/26.4 cm diagonal.
Trace Length	5 seconds.
Number of Traces	4 or 5 (Optional).
Resolution	640 x 480 pixels.

ECG	
Range	10 to 300 BPM.
Accuracy	±2% or ±2 BPM.
Sweep Speed	12.5, 25 mm/sec selectable.
Display Update Information	Display update interval is 2 seconds.
High Limit Range	50 to 250 BPM in 5 BPM steps.
Low Limit Range	20 to 150 BPM in 5 BPM steps.
Bandwidth	0.5 to 40 Hz (monitor); 0.05 to 100 Hz (diagnostic).
Leads	3 lead: I, II or III selectable. 5 Lead/Dual Vector: I, II, III, or V selectable.
Sensitivity	0.25 to 3 mV/cm selectable (12 levels).
Pacer Rejection	0.1 to 2 msec; 2 to 700 mV.
Tall T-wave Rejection Capability	Tall T-wave rejection of 1.2 mV with 1 mV R-wave.
Heart Rate Source	ECG, IBP, SpO2, NIBP.
Heart Rate Averaging Method	If the present HR is less than 100, the last 6 R-R intervals are averaged. If the HR is greater than 100, the last 12 R-R intervals are averaged.
Heart Rate Response Time	Response time to reach 105 bpm from 80 bpm with 120 bpm applied is 5.7 sec avg with range of 5.5 to 6 seconds. Response time to reach 54 bpm from 80 bpm with 40 bpm applied is 6.9 sec avg with range of 6.5 to 7 seconds.
Time to Alarm for Tachycardia	For waveform 4a. at 1 mV: 7.7 sec avg, 6-9 sec range. For waveform 4a. at 0.5 mV: 8.7 sec avg, 8-9.5 sec range. For waveform 4a. at 2 mV: 5.4 sec avg, 5.1-6.5 sec range. For waveform 4b. at 2 mV: 5.7 sec avg, 5.3-6.5 sec range. For waveform 4b. at 1 mV: 5.7 sec avg, 4.9-6.8 sec range. For waveform 4b. at 4 mV: 5.8 sec avg, 5.3-6.1 sec range.
Horizontal Time Bases	25, 12.5 mm/sec.
Vertical Ranges	0.25, 0.30, 0.40, 0.50, 0.65, 0.80, 1.0, 1.25, 1.50, 2.0, 2.5, 3.0 mv/cm.
Defib Tolerance	400 joules with 50 ohm series lead impedance.
Connector	Std 6 pins MS.
Isolation	Full electrical isolation.

Respiration	
Range	4 to 200 BPM.
Accuracy	±2% or ±2 BPM.
Lead	RA to LA.
Leads Off Sense	30 na DC per lead.
Resp Drive	10 vpp sinewave @ 1.2 mA @ 62.5 KHz.
Display Sensitivity	0.25 to 3 ohm/cm selectable.
Minimum Detection Sensitivity	0.1 to 1.2 ohm depending on display setting.
High Limit Range	5 to 150.
Low Limit Range	5 to 50.
Apnea Delay	10, 15, 20, 30, 40.
Sweep Speed	1.56, 6.25, 12.5, 25 mm/sec selectable.
Respiration Rate Source	EtCO2 or ECG Leads.
CVA Rejection	Rejects most cardiovascular coincidence.

Standard Temperature	
Channels	1 or 2.
Measurement Range	20 to 50° C (68 to 122° F).
Alarm Limit Range	20-44° C.
Accuracy	±0.1 ° C (±0.2 ° F).
Probe	YSI 700 or 400, autosensing.
Connector	1/4 inch (0.6 cm) stereo phone jack.

SureTemp Temperature	
Patient Temperature Range	28.9 to 42.2 ° C (84.0 to 108.0 ° F).
Predictive Temperature Range	34.5 to 42.2 ° C (94.0 to 108.0 ° F).
Accuracy	±0.1 ° C (±0.2 ° F).
Response Time	Oral - approx. 4 sec., Rectal - approx. 15 sec., Axillary – continuous.
Monitor Mode	3 minutes.
Cord Length	9 ft. or 16 ft.

NIBP	
Measurement Method	Oscillometric.
Measurement Range	Adult: Systolic: 30 to 275 mmHg Diastolic: 20 to 240 mmHg. Pediatric: Systolic: 30 to 170 mmHg Diastolic: 20 to 125 mmHg. Neonate: Systolic: 30 to 140 mmHg Diastolic: 20 to 100 mmHg.
Alarm Limit Range	Adult: Systolic: 50 to 240 mmHg. Mean: 40 to 200 mmHg. Diastolic: 30 to 180 mmHg. Pediatric: Systolic 25 to 165 mmHg. Mean: 15 to 135 mmHg. Diastolic: 10 to 120 mmHg. Neonate: Systolic: 25 to 135 mmHg. Mean: 15 to 105 mmHg. Diastolic: 10 to 95 mmHg.
Pulse Rate	30 to 250 BPM.
Measurement Time	40 seconds typical.
Modes	Manual: initiated via START key. Automatic: STAT, 1, 2, 3, 4, 5, 10, 15, 30, 45 minutes, 1, 2, 3, 4 hrs.
First Cuff Inflation	Adult: 90 to 220 mmHg. Pediatric: 60 to 140 mmHg selectable. Neonate: 60 to 140 mmHg selectable.
Subsequent Inflations	Systolic +30 mmHg.
Alarms	Systolic, Diastolic and Mean selectable in 5 mmHg steps.
System Accuracy	±5 mmHg mean error, ±8 mmHg SD.
Cuff Sizes	Thigh, Large Adult, Adult, Child, Infant, Neo sizes 1, 2, 3, 4.

SpO2 (Nellcor MP405)	
Display	% SpO_2, Plethysmographic Waveform or Pulse Amplitude Bar.
Range	0 to 100%.
Accuracy	Adult: 0 to 69% unspecified, 70 to 100% ±2 digits. Neonate: 0 to 69% unspecified, 70 to 100% ±3 digits.
Pulse Rate Range	20 to 250 BPM.
Pulse Rate Accuracy	±3 BPM.
High Limit Range	70 to 100%.

Low Limit Range	50 to 99%.
Sensors	Neonatal through Adult (NELLCOR).
Pulse Tone	Pitch varies with SpO_2 value.
ECG Sync	NELLCOR C-LOCK.

SpO2 (Masimo SET)	
Display	% SpO2, Plethysmographic Waveform or Pulse Amplitude Bar.
Range	1 to 100%.
Accuracy	Calibrated to functional saturation.
Saturation (% SpO2) during NO motion conditions	Adult/Pediatric: 70 to 100% ±2 digits. Neonatal: 70 to 100% ±3 digits.
Saturation (% SpO2) during motion conditions	Adult/Pediatric: 70 to 100% ±3 digits. Neonatal: 70 to 100% ±3 digits.
Pulse Rate	25 to 240 bpm ±3 digits (Adult, Ped, and Neo).
Low Perfusion Performance	>0.02% Pulse Amplitude. Saturation (%SpO2) ±2 digits and %Transmission > 5% Pulse Rate (bpm)±3 digits.
High Limit Range	70 to 100%.
Low Limit Range	50 to 99%.
Sensors	Neonatal through Adult (Masimo).
Pulse Tone	Pitch varies with SpO2 value.

Invasive Pressure	
Channels	1, 2, or 3.
Range	-40 to 300 mmHg.
Accuracy	±1% or ±1 mmHg.
Parameter Display	SYS, DIAS, and MEAN selectable.
Pressure Labels	ART, PA, CVP, ICP, RA, LAP, FEM, UA, UV, PRES.

Alarm Limit Range	Adult: Systolic: 0 to 240 mmHg. Mean: 0 to 200 mmHg. Diastolic: 0 to 180 mmHg. Pediatric: Systolic 0 to 210 mmHg. Mean: 0 to 170 mmHg. Diastolic: 0 to 150 mmHg. Neonate: Systolic: 0 to 210 mmHg. Mean: 0 to 170 mmHg. Diastolic: 0 to 150 mmHg.
Display Scale	15, 30, 60, 120, 180, 240 mmHg selectable.
Input Connector	Std 6 pin MS, 5 uV/V/mmHg.

Cardiac Output/Hemodynamic Calculations	
CO Range	0.1 to 19.99 liters/minute.
CO Repeatability	±2% or 0.2 liters/minute from mean value, whichever is greater, as measured by electronically generated standard flow curves.
REF Range	1% to 85%.
Blood Temperature Range	17.5 to 43° C.
Blood Temperature Accuracy	±0.5° C from 17.5 to 31° C, ±0.3° C from 31 to 43° C.
Injectate Temperature Range	0 to 27° C.
Injectate Temperature Accuracy	±0.3° C from 0 to 25° C, ±0.5° C from 25.5 to 27° C.
Hemodynamic Calculations Provided	CI, SV, SVI, SVR, SVRI, PVR, PVRI, LVSW, LVSWI, RVSW, RVSWI, REF, PAWP,BSA.
Catheters & Accessories	Baxter-Edwards compatible.

ETCO2	
Type	Oridion Module.
Noise Emission	45 db.
Operating Temperature	0 to 50° C.
Maximum Change Rate in Temperature	0.5° C.
Operating Pressure	430 to 795 mmHg.
Maximum Change Rate in Pressure	12.4 mmHg/min.
Operating Altitude	-1,250 to 15,000 ft.
Maximum Change Rate in Altitude	500 ft./min.
Relative Humidity	10 to 95%.
Ambient CO2	0 to 700 ppm.
Flow Rate	50 ml.min ±7.5 ml/min.
Resp Range	0 to 150 bpm.
BTPS	37° C, 47 mmHg.
System Response Time	2.9 seconds.
Rise Time Adult and Neonatal	190 msec max.
Delay Time	2.7 seconds typical.
CO2 Report Resolution	1 mmHg.
Calibration Interval	4000 operating hours or I year.
Power	Normal Operation: 1.5 Watts. In AutoZero Mode: 2.5 Watts. MediCO2 Standby Mode: 0.9 Watts. Initialization Mode: 4.7 Watts.
Accuracy	0 to 20 minutes: ±4 mmHg** at 0 to 38 mmHg*. ±12% of reading** at 39 to 99 mmHg*. 20 minutes and up: ±2 mmHg** at 0 to 39 mmHg*. ±5% of reading + 0.08% of every 1 mmHg above 40 mmHg** at 39 to 99 mmHg*.
The accuracy is maintained to within 4% for the following Vol. % gas mixtures:	CO2: 0 to 13. N2: 0 to 97.5. O2: 0 to 100. N2O: 0 to 80. H2O: Dry-saturated. Anesthetic Agents: According to EN864.
Leak Tightness	The leak rate of the module flow system is less than 40 mBar per minute when a 30% vacuum is invoked on the flow system.
* CO2 Concentration at sea level. ** Accuracy applied for breath rates of up to 80 bpm. For breath rates above 80 bpm, accuracy complies with EN 864/ISO 9918 (4 mmHg or 12% of reading whichever is greater.	

Thermal Recorder	
Channels	Any 1 or 2 waveforms, user selectable.
Resolution	8 dots/mm vertical, 32 dots/mm horizontal.
Paper	40 mm grid; 50 mm width.
Sweep Speed	6.25, 12.5, 25 mm/sec; 1 mm/sec Trend.
Manual Record Duration	16 seconds, 12 seconds memory.
Annotation	Time, date, parameter values, scales, source, speed.
Weight	0.85 lb (0.39 kg) with full roll of paper.

AutoNet Transceiver Module	
Indicator	Green light indicates comm. Status.
Frequency	Spread spectrum 902 to 928 MHz or 2.4 GHz.
Transmission	Bidirectional with seamless auto-retry.
Weight	0.55 lb (0.25 kg).

Telemetry Receiver Module	
Frequency Range	UHF 450 to 470 MHz (20012/20012V).
Frequency Range	UHF 608 to 614 MHz (20012V-M6).
Sensitivity	1 uV typical.
Available Transmitters	Angel, Angel-MP, ESCORT Guardian models 20601,20602, 20603.
Weight	0.85 lb (0.39 kg).

CIS Interface Module	
Size	13.5 x 6.6 x 3.4 cm (HWD).
Weight	0.50 kg.
Network Interface	IEEE 802.3 10 BaseT Ethernet RJ45.
Serial Interface	2 shielded EIA/TIA RS232 (9-pin mini-DIN) ports, 1 shielded EIA/TIA RS 485 IEEE 1073.4.1 MIB compliant) port.
Keyboard Interface	PS/2 Compatible (6-pin mini-DIN).
Interface Software	TCP/IP and HL7 – other protocols/data formats available at additional cost.
Ancillary Devices	Driver software required for each different device type at additional cost.

Patent Information	
MDE US Patents	4,757,520; 4,922,918.
Nellcor US Patents	4,621,643; 4,830,014; 4,700,708; 4,770,179; 4,869,254; 4,685,464; 4,802,486.
Masimo US Patents	5,482,036; 5,490,505; 5,632,272; 5,685,299; 5,758,644; 5,769,785; 6,002,952; 6,036,642; 6,067,462; 6,206,830; 6,157,850; 6,002,962.
Oridion US Patents	4,755,675; 5,300,859; 5,063,275; 5,675,750; 5,875,461.

APPENDIX B
SUPPLIES, ACCESSORIES & OPTIONS

B.0 SUPPLIES, ACCESSORIES & OPTIONS.

The supplies and accessories listed in this Appendix can be ordered by calling Invivo)MDE at the following numbers: (888) 221-1593 / (818) 768-6411.

To make the ordering process smoother, note the part or option/model number of the items(s) you are ordering, and be prepared to give the number to Invivo)MDE personnel.

Starter Kits

Item Description	Part Number
Masimo Adult Accessory Kit. Consists of: 5-Lead ECG cable, 5-Lead Snap Leadwires, Adult NIBP Hose & Cuff, Masimo 8 foot SPO2 extension cable, Masimo Sensor Starter Kit	E100002
Masimo Pediatric Accessory Kit. Consists of: 3-Lead ECG cable, 3-Lead Pinchclip Leadwires, NIBP Hose, Pediatric Cuff, Masimo 8 foot SPO2 extension cable, Masimo Sensor Starter Kit	E100004
Masimo Neonatal Accessory Kit. Consists of: 3-Lead ECG cable, Neonatal NIBP Hose, Masimo 8 foot SPO2 extension cable, Masimo Sensor Starter Kit	E100006
Nellcor XL Adult Accessory Kit. Consists of: 5-Lead ECG cable, 5-Lead Snap Leadwires, Adult NIBP Hose & Cuff, Nellcor MC-10 SPO2 10 foot cable, Oxisensors	E100009
Nellcor XL Pediatric Accessory Kit. Consists of: 3-Lead ECG cable, 3-Lead Pinchclip Leadwires, NIBP Hose, Pediatric Cuff, Nellcor MC-10 SPO2 10 foot cable, Oxisensors	E100010
Nellcor XL Neonatal Accessory Kit. Consists of: 3-Lead ECG cable, Neonatal NIBP Hose, Nellcor MC-10 SPO2 10 foot cable, Oxisensors	E100011

Batteries

Battery (3.5 hours)	E2700-37SE7

ECG (U.S.A.)

3-Lead ECG Safety Cable	E2900-01
24 inch 3-Lead Neo Safety Pinchclip Leadwires (1 set)	401503
24 inch 3-Lead Snap Safety Leadwires (1 set)	401603
5-Lead ECG Safety Cable	E2900-02
24 inch 5-Lead Neo Safety Pinchclip Leadwires (1 set)	401504
24 inch 5-Lead Snap Safety Leadwires (1 set)	401604
24 inch HP 3-Lead ECG Safety Cable	E2700-24
24 inch HP 5-Lead ECG Safety Cable	E2700-25
24 inch ECG Electrode Set – For Veterinarian use	E2700-27
24 inch HP 3-Lead Shielded Snap Leadwires	E2700-43
24 inch HP 3-Lead Safety Pinchclip Leadwires for E2700-24	E2700-46
24 inch HP 5-Lead Safety Pinchclip Leadwires for E2700-25	E2700-47
24 inch 3-Lead Neonatal Safety Pinchclip Leadwires (5 sets)	E2700-62
24 inch 5-Lead Neonatal Safety Pinchclip Leadwires (5 sets)	E2700-75
24 inch 5-Lead Safety Snap Leadwires (10 sets)	E2700-77
24 inch 3-Lead Safety Snap Leadwires (10 sets)	E2700-78

ECG (CE Approved)

Item Description	Part Number
3-Lead ECG Safety Cable (Red, Yellow, Green)	E2900-03
5-Lead ECG Safety Cable (Red, Yellow, Green, Black, White)	E2900-04
24 inch 3-Lead Safety Snap Leadwires (Red, Yellow, Green) (10 sets)	E2700-60
24 inch 3-Lead Safety Pinchclip Leadwires (1 set)	401505
24 inch 5-Lead Safety Pinchclip Leadwires (1 set)	401506
24 inch 5-Lead Neonatal Safety Pinchclip Leadwires (5 sets)	E2700-76
24 inch 5-Lead Safety Snap Leadwires (Red, Yellow, Green, Black, White) (10 sets)	E2700-61
24 inch 3-Lead Neonatal Safety Pinchclip Leadwires (5 sets)	E2700-63

ECG (ESIS)

ESIS Patient Cable 5-Lead USA	E2800-30
ESIS Patient Cable 5-Lead CE	E2800-31
ESIS Leadwire Set 5-Lead 36 inch Snap USA	E2800-32
ESIS Leadwire Set 3-Lead 36 inch Snap USA	E2800-33
ESIS Leadwire Set 5-Lead 36 inch Snap CE	E2800-34

ETCO2

Adult/Pediatric Filterline & Airway Adapter Set, for intubated CO2 sampling, 6 foot (box of 25)	E2910-20
Adult/Pediatric Filterline & Airway Adapter Set, High Humidity, for long term intubated CO2 sampling, 6 foot (box of 25)	E2910-21
Infant/Neonatal Filterline & Airway Adapter Set, High Humidity, for intubated CO2 sampling, 6 foot (box of 25)	E2910-22
Adult O2/CO2 Nasal Filterline, non-intubated CO2 sampling (box of 25)	E2910-35
Pediatric O2/CO2 Nasal Filterline, non-intubated CO2 sampling (box of 25)	E2910-34
Adult Nasal Cannula with Filterline (box of 25)	E2910-28
Pediatric Nasal Cannula with Filterline, non-intubated CO2 sampling (box of 25)	E2910-29
Infant/Neonatal Nasal Cannula with Filterline, non-intubated CO2 sampling (box of 25)	E2910-30

NIBP

Quick Disconnect Type Fittings

NIBP Cuff Thigh, CE	E2910-01
NIBP Cuff Large Adult, CE	E2910-02
NIBP Cuff Adult, CE	E2910-03
NIBP Cuff Child, CE	E2910-04
NIBP Cuff Infant, CE	E2910-05
Neo Size 1. Box of 10	E2910-06
Neo Size 2. Box of 10	E2910-07
Neo Size 3. Box of 10	E2910-08
Neo Size 4. Box of 10	E2910-09
NIBP Cuff Small Adult, CE	E2910-10
Adult NIBP Hose	E2810-06
Neonatal NIBP Hose	E2810-11
SE to EII NIBP Cuff Adapter	E2810-12
EII to SE NIBP Cuff Adapter Screw fitting to Quick Disconnect	E2810-13

Screw Type Fittings

Adult / Pediatric Hose Assembly (12 foot)	E2800-06
Neonatal Hose Assembly (8 foot)	E2800-11
SE to EII NIBP Cuff Adapter (Quick disconnect to screw fitting)	E2810-12
EII to SE NIBP Cuff Adapter (Screw fitting to Quick Disconnect)	E2810-13

NIBP (Continued)

Item Description	Part Number
Neo Size 1. Box of 10	E2910-06
Neo Size 2. Box of 10	E2910-07
Neo Size 3. Box of 10	E2910-08
Neo Size 4. Box of 10	E2910-09
NIBP Cuff Infant	E2910-12
NIBP Cuff Child	E2910-13
NIBP Cuff Small Adult	E2910-14
NIBP Cuff Adult	E2910-15
NIBP Cuff Large Adult	E2910-16
NIBP Cuff Thigh	E2910-17
NIBP Board Exchange Kit, MPM	404016
NIBP Connectors Conversion Kit	404017
Hose Conversion Kit	403958
Male Screw-on Fittings Plastic	360700-0020

Mounting Hardware

GCX Plate	401609
Wall Mount less Wall Channel	E2700-34
Wall Mount with Wall Channel	E2700-10
Rolling Stand	E2700-11
Fast Track Mount (for use with GCX mounts)	E2700-16
6 inch Rolling Stand Utility Basket with SureTemp holder	E2700-90
6 inch Wall Mount Utility Basket with SureTemp holder	E2700-91

SpO2 (Masimo)

Adult Finger Sensor. Reusable	E2810-50
Adult Disposable Adhesive Sensors (box of 20)	E2810-51
Pediatric Disposable Adhesive Sensors (box of 20)	E2810-52
Neonatal Disposable Adhesive Sensors (box of 20)	E2810-53
Neonatal and Preterm Disposable Adhesive Sensors (box of 20)	E2810-54
Neonatal Masimo SpO2 Adhesive Sample pack	E2810-55
Adult/Pediatric Masimo SpO2 Adhesive Sample pack	E2810-56
SpO2 Masimo Replacement Tape 100 (pk) (For use with E2810-53)	E2810-57
SpO2 Masimo Replacement Posey Wrap (12 pk) (For use with E2810-54)	E2810-58
SpO2 Extension Cable, 4 foot	E2810-59
SpO2 Extension Cable, 8 foot	E2810-60
SpO2 Extension Cable, 12 foot	E2810-61

SpO2 (Nellcor)

Nellcor Durasensor. Reusable	E2800-50
Nellcor MC-10 Pulse Oximetry Cable, 10 foot	E2800-64

SureTemp Supplies

SureTemp Oral Probe	E2900-55
SureTemp Rectal Probe	E2900-56
SureTemp Probe Covers – Disposable (box of 500)	E2900-57
SureTemp Probe Covers Snap on Holder for Monitor	E2900-58
SureTemp Probe Covers – Disposable (case of 1000)	E2900-62

Remote Display

17 inch Color Remote Display	E3202-05
21 inch Color Remote Display	E3202-06

Remote Display (Continued)

Item Description	Part Number
18 inch Color Remote Display. Flat Panel	E3202-08
17 inch Remote Display Ceiling Mount	E2900-90
17 inch Remote Display Wall Mount	E2900-91
21 inch Remote Display Ceiling Mount	E2900-94
21 inch Remote Display Wall Mount	E2900-95
18 inch Flat Panel Remote Display Wall Mount	E2900-98
Video Cable	
25 Foot Standard Cable	E2800-SC25
50 Foot Standard Cable	E2800-SC50
50 Foot Plenum Cable	E2800-PC50
Power Isolation Transformers	
Power Isolation Transformer 150VA floor mount, single outlet 110 volts	E2900-49
Power Isolation Transformer 150VA wall mount, single outlet 110 volts	E2900-50

Miscellaneous

Monitor Accessory Pouch – Snaps to side of monitor	E2700-14
Recorder Paper (box of 10 rolls)	E2700-32
Recorder Paper (case of 100 rolls)	E2700-54
Power Cord USA – Replacement	E2700-87
Cable Strap – Snaps to monitor for cable management when monitor is not in use	E2900-51
Power Cord Clamp	E2900-30
Nurse Call Interface Cable (unterminated)	E2900-31
High Level Interface Cable	E2900-33

Educational Material

Escort M10 Operator's Manual	E9030-38
Operator's Manual CDROM	XXXXX
Escort M10 Quick Reference Guide	E9040-56
Escort M10 Service Manual	E9040-64
Service Manual CDROM	XXXXX

Escort M10 Options

VGA Output for Escort M10 series monitors. Permits all Escort M10 waveforms and numeric data to be displayed on any standard VGA display. The remote display may require an Isolation Transformer depending upon its location. Remote Display, Isolation Transformer can be purchased from a commercial source or Invivo)MDE.	OPT53-SE
Add 5th Trace	OPT70-SE
Add MASIMO SPO2 parameter	OPT30-SEM
Add NELLCOR OxismartXL SpO2 parameter	OPT30-SENEL
Add EtCO2 Microstream Technology parameter	OPT36-SE
OXY CRG's. Provides Oxycardiorespirograms when purchased when a respiration option is included.	OPT37-SE
Add one (1) Invasive Blood Pressure parameter	OPT31-SE
Add two (2) Invasive Blood Pressure parameters	OPT33-SE
Add three (3) Invasive Blood Pressure parameters	OPT48-SE
CARDIAC OUTPUT with HEMODYNAMIC CALCS. Requires purchase of (2) or (3) Invasive Blood Pressures	OPT72-SE
CARDIAC OUTPUT with HEMODYNAMIC CALCS / ETCO2 Combination. Requires purchase of (2) or (3) Invasive Blood Pressures. Microstream ETCO2.	OPT73-SE
SureTemp Electronic Thermometer. Provides episodic measurement of patient temperature, oral, axillary, rectal	OPT54-SE

Escort M10 Options (Continued)

Item Description **Part Number**

Add second Standard Temperature parameter.
Add second standard temperature to any single temp option..... OPT50-SE
Recorder – Dual Channel, Thermal array.
Add integral dual-channel recorder to provide documentation of all vital sign waveforms and numeric data..... OPT03-SE
High level outputs (alarm relay, defib-sync & analog out)..... OPT61-SE
Bedrail Handle.
Add Bedrail Handle to Escort M10 ..... OPT25-SE
Accessory Snaps (set of 4, installed) OPT105-SE

Wireless Communication Modules

Vision Transceiver Module (900 MHz Band).
Spread Spectrum communication with Vision central station. Requires (1) per monitor..... 20011V
Escort M10 Link Transceiver Module (900 MHz Band).
Spread Spectrum communication with existing E3200B central stations. Requires (1) per monitor..... 20011
Vision Transceiver Module (2.4 GHz Band).
Spread Spectrum communication with Vision central station in the 2.4 GHz Band. Requires one (1) per monitor. 20019V
Vision Transceiver Module (2.4 GHz BAND), SP.
Spread Spectrum communication with Vision central station in the 2.4 GHz Band. Requires one (1) per monitor. **(FOR USE IN FRANCE)** 20019V

Guardian Receivers (Bedside)

Telemetry Bedside Receiver Module (450-470 MHz).
For bedside monitor to receive Guardian telemetry transmitter signal. Requires Guardian transmitter. One required for each transmitter to be monitored. 20012V
Telemetry Bedside Receiver Module (608-614 MHz).
For bedside monitor to receive Guardian telemetry transmitter signal. Requires Guardian transmitter. One required for each transmitter to be monitored. 20012V-M6

CIS Communication Modules (Bedside)

Meditech CIS Communication Module 20030-MT1
HBOC CIS Communication Module..... 20030-HB1
Cerner CIS Communication Module 20030-CN1
Eclipsys CIS Communication Module 20030-EC1
RS232 Communication Module 20030-RS232
MDE Engineering CIS Software Support..... E9040-26

APPENDIX C
ESCORT M10 SPARE PARTS LIST

C.0 ESCORT M10 SPARE PARTS LIST.

PCBA's

Item Description	Part Number
Power Supply PCBA	403478
Masimo PCBA	403695
Nellcor MP405 PCBA	404071
Aux. Out Option PCBA	403511
CPU*	404296

NOTE

*When calling InvivoMDE Technical Support to order a CPU PCBA, have available the model and serial number of the monitor, type and version of SPO2, and version of SureTemp (if applicable). There are several different CPU part numbers depending on the configuration of the monitor. The 404296 part number is the base PCBA number only.

Power Invertor (Backlight Driver) NEC-Both -18 & -29	382000-0077
LCD Conn. Adapter (NEC) (Models 20411, 20413 & 20414)	403826

Display and Bezel

New Bezel Assy.	403828
Display, LCD (NEC) Model -18 Newer	362000-0083
Window, LCD/EL Disp. Prism	402926

Mechanical

Power Module Assy.	403671
15Vdc Power Supply Mount	403617
Recorder Cable Assy.	403754
Rear Housing Assy.	403489
Fan Assy.	401884

Mechanical (Continued)

Item Description	Part Number
Pump Bracket	404175
Battery Cover Assy.	404016
BP Connector	403607

Connector Panels

Connector Panel Assy - Masimo (Screw Type NIBP)	404014
Connector Panel Assy - Nellcor MP405	404076

Connector Panel Overlays

ECG, SPO2, NIBP, 2YSI TEMP....403472
ECG, SPO2, NIBP, 2YSI TEMP, BP1....403690
ECG, SPO2, NIBP, 2YSI TEMP, BP1, BP2....403689
ECG, SPO2, NIBP, 2YSI TEMP, BP1, BP2, BP3....403688
ECG, SPO2, NIBP, 2YSI TEMP, BP1, CO2....403852
ECG, SPO2, NIBP, 2YSI TEMP, BP1, BP2, CO2....403853
ECG, SPO2, NIBP, 2YSI TEMP, BP1, BP2, BP3, CO2....403854
ECG, SPO2, NIBP, 2YSI TEMP, BP1, BP2, CO....403850
ECG, SPO2, NIBP, 2YSI TEMP, BP1, BP2, BP3, CO....403851
ECG, SPO2, NIBP, 2YSI TEMP, BP1, BP2, CO, CO2....403856
ECG, SPO2, NIBP, 2YSI TEMP, BP1, BP2, BP3, CO, CO2....403857

Cables

Ext. DC Jack Cable....403614
Video Cable, CPU to Display....403710
Speaker/Cable Assy.....403407
Power Cable, Power Mod. to 15Vdc Supply....403594
Cable Assy., P/S to P/S....403613
Cable Assy., Batt. to P/S....403621

Miscellaneous

ECG Cable Assy.....403733
Pneumatic Assy.....403650
NIBP Pump Assy.....403475
Valve Assy.....403558
SureTemp 678 Board....404087
SureTemp Housing Assy....403552
SureTemp Overlay....403551
SureTemp Cable Assy. (OEM 678)....404075
SureTemp Interface PCBA....403522
SureTemp Switch w/Cable (OEM 678)....404084
SureTemp Probe Tube Assy. (OEM 678)....404056
IBP Connector....403607
YSI Temp. Connector....354000-0303
Recorder Assembly....403728
15Vdc Power Supply....382000-0082

APPENDIX D
SCHEMATICS

D.0 SCHEMATICS.

This Appendix contains the necessary Escort M10 monitor schematics. The schematics included are:

- ESCORT M10 POWER SUPPLY SCHEMATIC
  (sheet 1 of 3) #403478
- CPU/PARA, NIBP CE, ESCORT M10 SCHEMATIC
  (sheets 1-12 of 14) #404296
- ESCORT M10 OPT ACCESSORIES SCHEMATIC
  (sheet 1 of 2) #403511
- ESCORT M10 FLEX CIRCUIT SCHEMATIC
  (sheet 1 of 1) #403545

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LAST USED

C92, D26, J1, JP2, K1, L4, P3, Q12, R88, T1, TH3, U17, VR1,

UNUSED LABELS

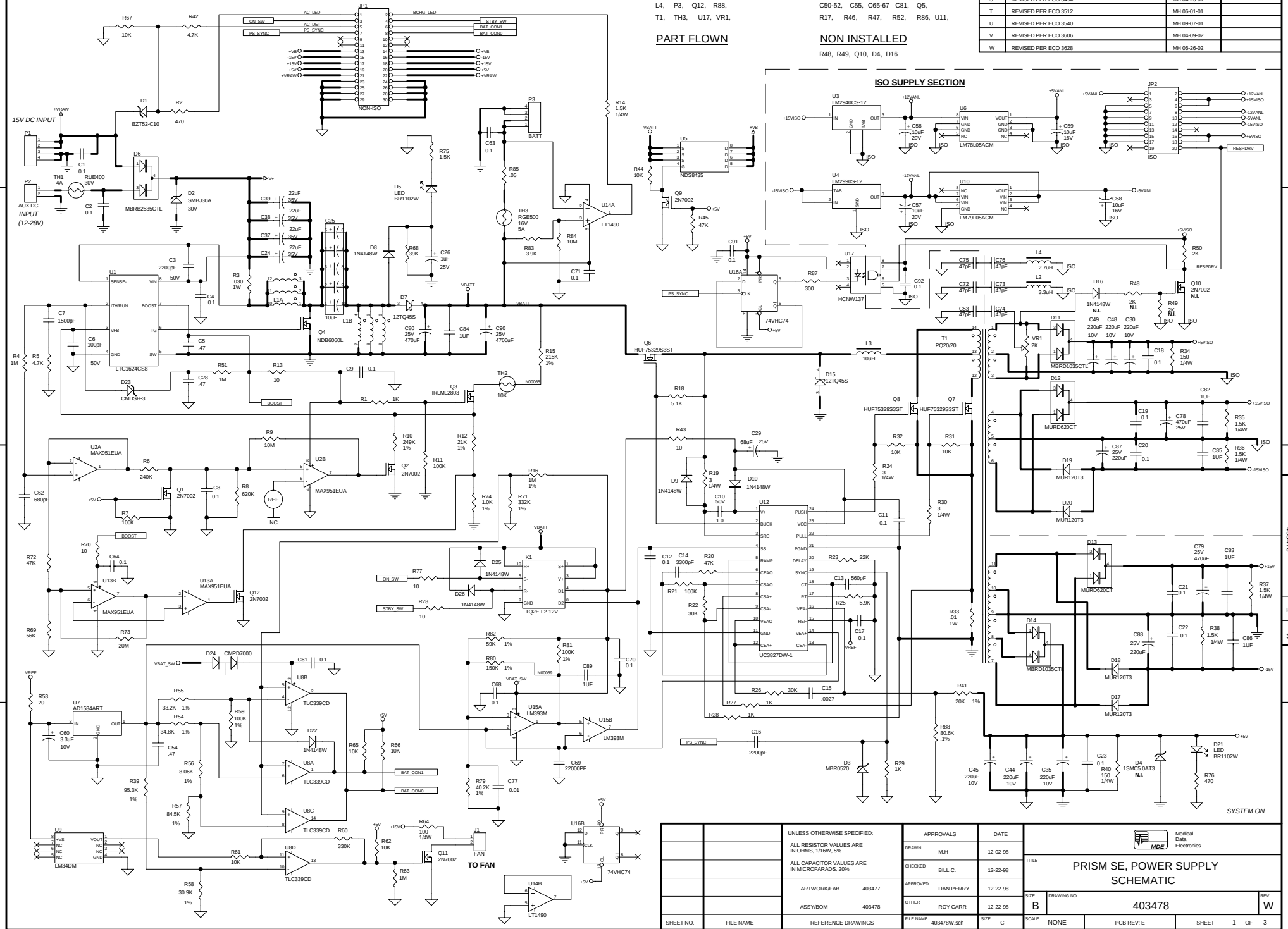
C27, C31-34, C36, C40-43, C46, C47, C50-52, C55, C65-67 C81, Q5, R17, R46, R47, R52, R86, U11,

PART FLOWN

NON INSTALLED

R48, R49, Q10, D4, D16

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
S	REVISED PER ECO 3494	MH 04-23-01	
T	REVISED PER ECO 3512	MH 06-01-01	
U	REVISED PER ECO 3540	MH 09-07-01	
V	REVISED PER ECO 3606	MH 04-09-02	
W	REVISED PER ECO 3628	MH 06-26-02	



		UNLESS OTHERWISE SPECIFIED:	APPROVALS	DATE	Medical Data Electronics
		ALL RESISTOR VALUES ARE IN OHMS, 1/16W, 5%	DRAWN M.H	12-02-98	TITLE: PRISM SE, POWER SUPPLY SCHEMATIC
		ALL CAPACITOR VALUES ARE IN MICROFARADS, 20%	CHECKED BILL C.	12-22-98	
		ARTWORK/FAB 403477	APPROVED DAN PERRY	12-22-98	SIZE B / DRAWING NO. 403478 / REV W
		ASSY/BOM 403478	OTHER ROY CARR	12-22-98	
SHEET NO.	FILE NAME	REFERENCE DRAWINGS	FILE NAME 403478W.sch	SIZE C	SCALE NONE / PCB REV: E / SHEET 1 OF 3

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REVISIONS			
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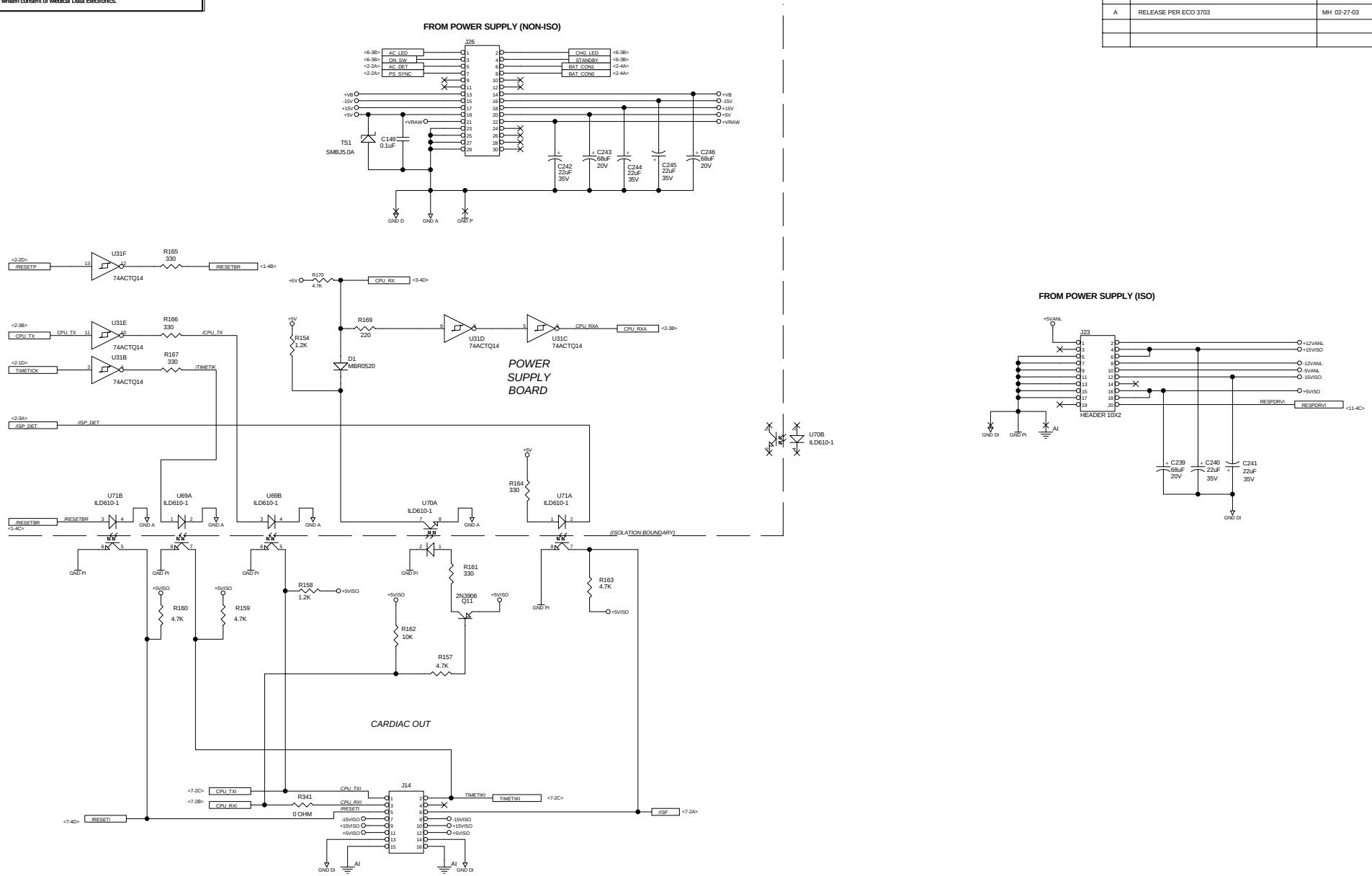

LAST USED

BT1, C287, D57, DS6, FL12, J27, JP2, L57, P1, Q14, R479, RP8, T1, TH1, TS1, U102, VR10, X2, Y2

UNUSED LABELS

C8, C41, C43-48, C147, C172, C213, C221, C230, C232, C238, C247, C248, C260, C273, D23, D37, D38, D51-53, J5, J19, J22, JP1, L20, R126, R173, R251, R269, R275-277, R280, R287, R295, R313, R333, R344-346, R352- 413, R429, R430, R455, R467-470, R475, RP5, RP6, U8-11, U13, U26, U64-68, U72, U98, VR8

NON INSTALLED

C23, C37-40, C283, C284, C287, R45, R46, R54, R156, R203, R244, R298, R302, R303, R305, R307 R323, R337, R473, R474, J3, J6A, J6B, J13, J27, U14

PARTS FLOWN

		UNLESS OTHERWISE SPECIFIED: ALL RESISTOR VALUES ARE IN OHMS, 1/16W, 5%	APPROVALS	DATE	MDE MEDICAL DATA ELECTRONICS
			DRAWN MIKE HOV.	10-08-98	TITLE: CPU/PARA, NIBP CE, PRISM SE SCHEMATIC
			CHECKED		
		ARTWORK/FAB 404295	APPROVED		SIZE B · DRAWING NO. 404296 · REV A
		ASSY/BOM 404296	OTHER		
SHEET NO.	FILE NAME	REFERENCE DRAWINGS	FILE NAME ISO.SCH	SIZE C	SCALE NONE · PCB REV: A · SHEET 1 OF 14

DWG NO 404296 · SHT 1 · REV A

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REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
A	SEE SHEET 1		

32MHZ

R T CLK

128K X 8 RAM

256K X 8 ROM

M1

WATCHDOG

KEYBD DECDR

TIMER/COUNTER

RCDR INTRF

SIZE	DRAWING NO.	REV
B	404296	A

FILE NAME	SIZE	SCALE		
CPU1.SCH	C	NONE	PCB REV: A	SHEET 2 OF 14

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REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
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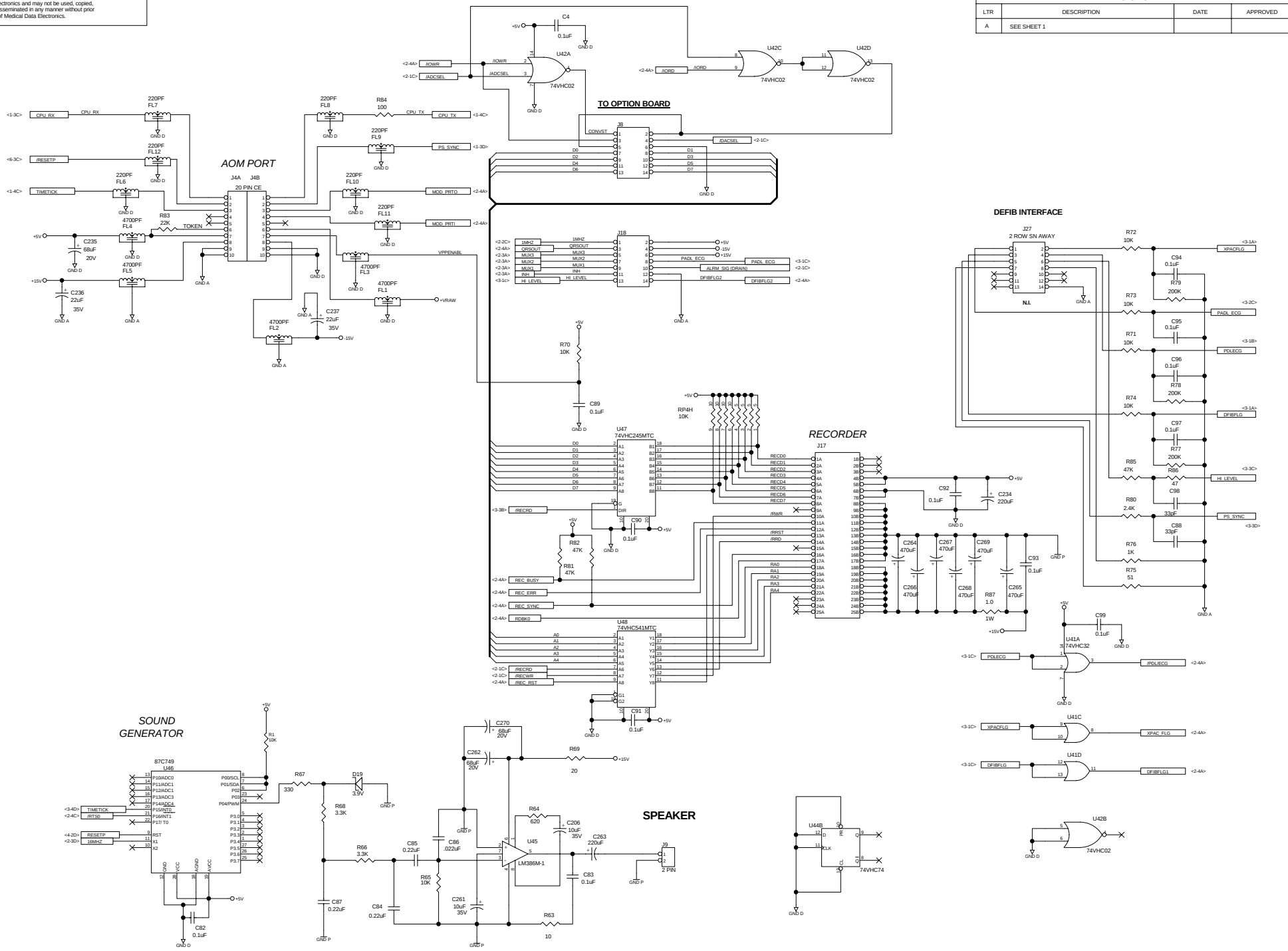

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REV	A
FILE NAME	CPU2.SCH
SIZE	C
SCALE	NONE
PCB REV: A	
SHEET	3 OF 14

DWG NO 404296 SHT 3 REV A

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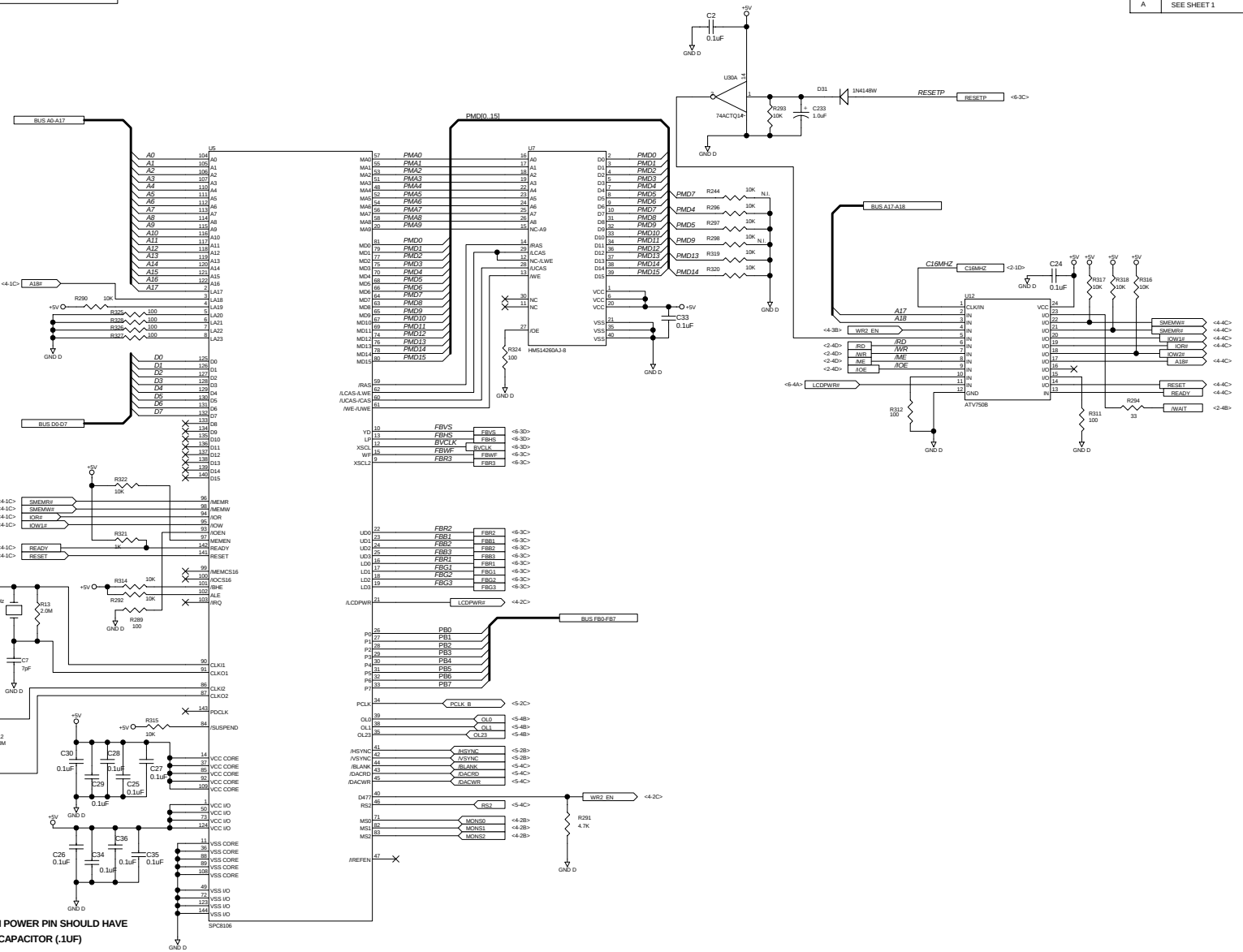

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B	404296	A

FILE NAME	SIZE	SCALE		
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DWG NO 404296 SHT 4 REV A

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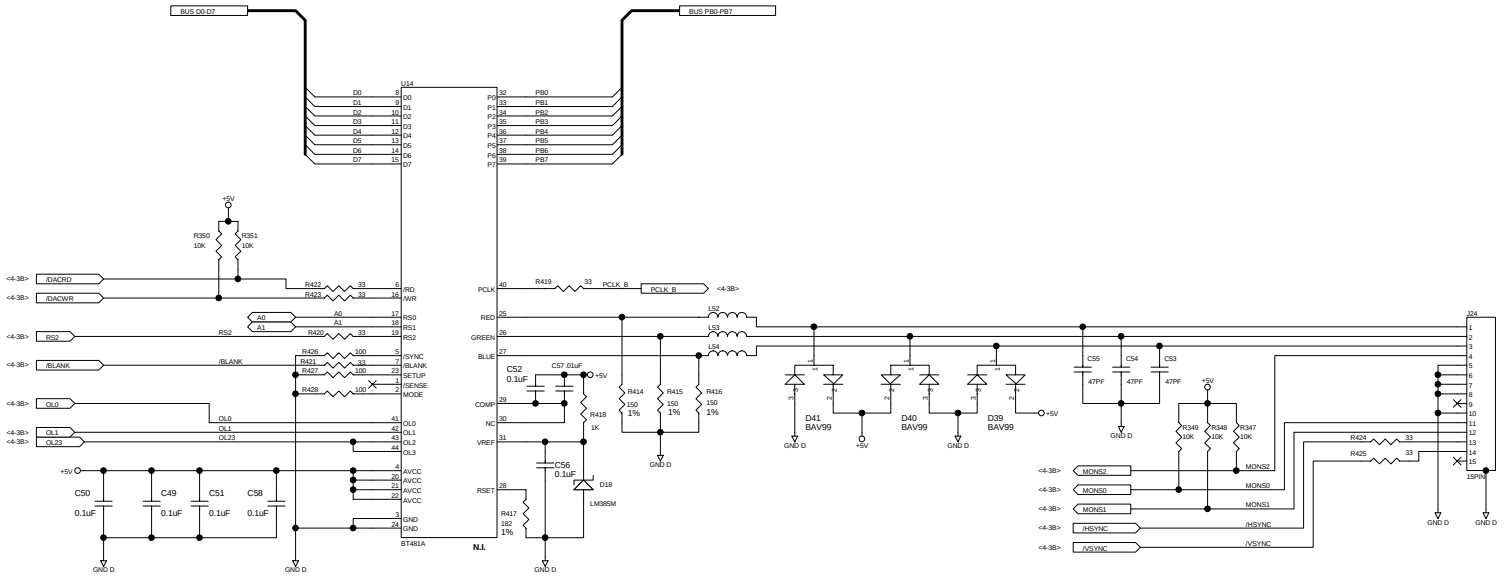

EACH POWER PIN SHOULD HAVE ONE CAPACITOR (.1UF)

SIZE	DRAWING NO.	REV
B	404296	A

FILE NAME	SIZE	SCALE		
CONTROL2.SCH	C	NONE	PCB REV: A	SHEET 5 OF 14

DWG NO 404296 SHT 5 REV A

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A	SEE SHEET 1		

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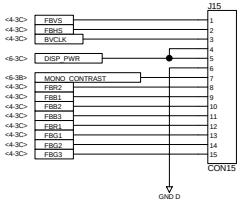
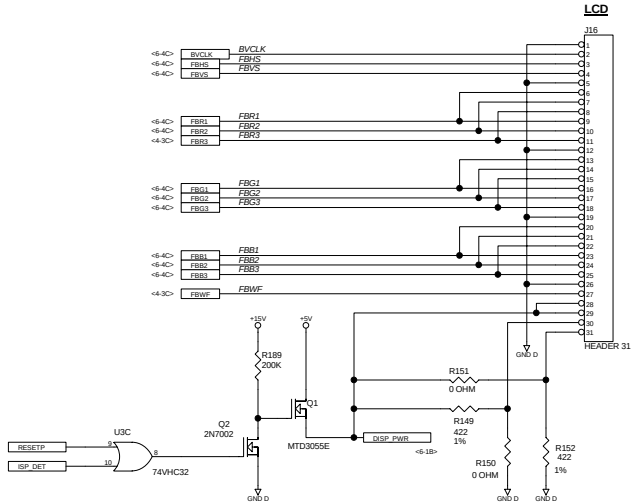
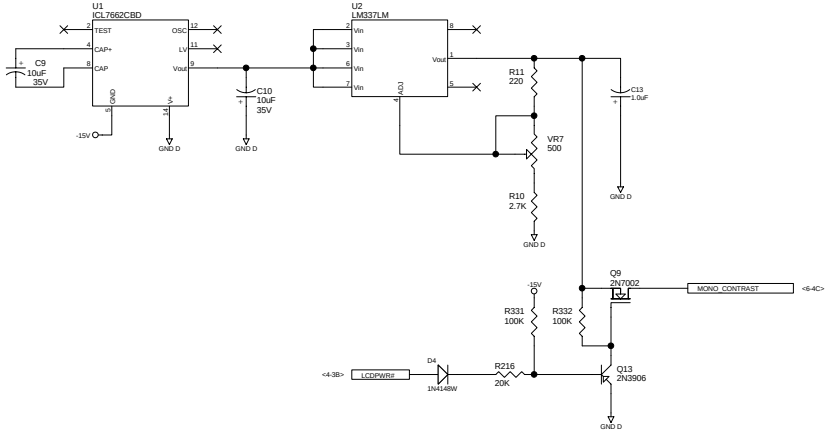
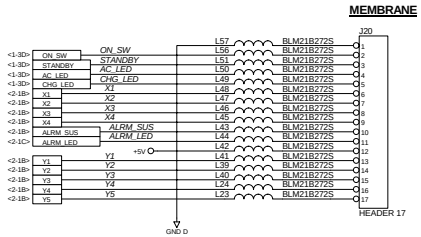


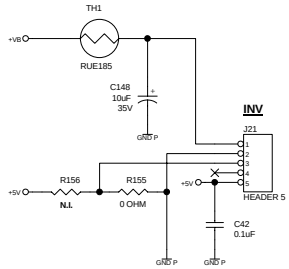
LCD





MEMBRANE





SIZE B	DRAWING NO. 404296		REV A
FILE NAME INTERF.SCH	SIZE C	SCALE NONE	PCB REV: A	SHEET 6 OF 14

DWG NO 404296 SHT 6 REV A

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REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	SEE SHEET 1		

WATCHDOG

CPU BUS

PAL DECODER

FLASH ROM

RAM

SURE TEMP TYPE

SIZE B	DRAWING NO. 404296		REV A
FILE NAME NIBP1.SCH	SIZE C	SCALE NONE	PCB REV: A	SHEET 7 OF 14

DWG NO 404296 SHT 7 REV A

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REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	SEE SHEET 1		

BLOOD PRESSURE #1

BLOOD PRESSURE #2

BLOOD PRESSURE #3

TEMPERATURE #1

TEMPERATURE #2

REGULATORS

INSTALL "B" RESISTORS FOR OEM 678

INSTALL "A" RESISTORS FOR OEM 675

SIZE B	DRAWING NO. 404296			REV A
FILE NAME NIBP2.SCH	SIZE C	SCALE NONE	PCB REV: A	SHEET 8 OF 14

DWG NO 404296 SHT 8 REV A

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REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
A	SEE SHEET 1		

MEMORY DECODE

128K FLASH

32K RAM

I/O DECODE

I/O PORT

SIZE	DRAWING NO.	REV
B	404296	A

FILE NAME	SIZE	SCALE		
PRO1.SCH	C	NONE	PCB REV: A	SHEET 9 OF 14

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REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
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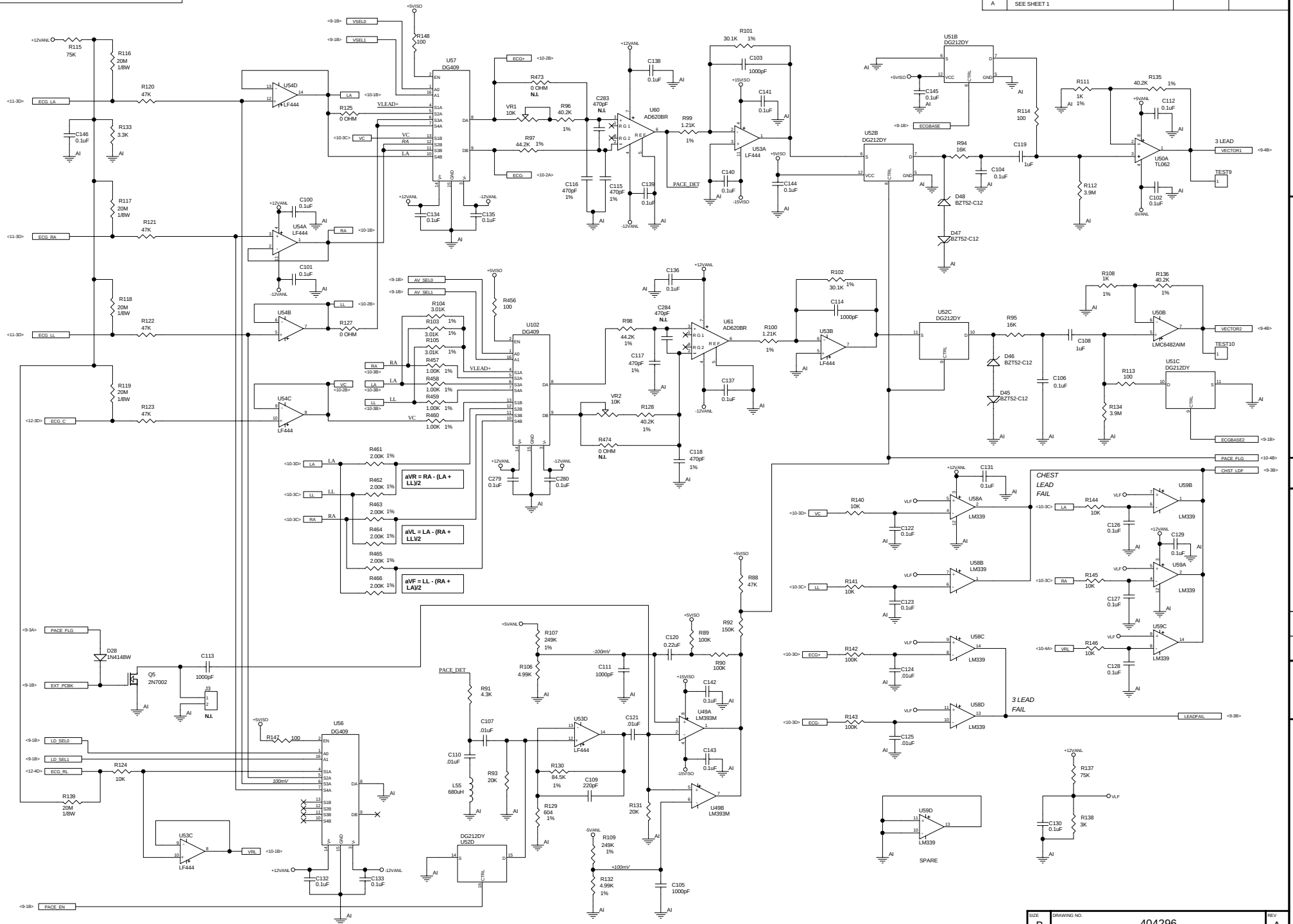

SIZE	DRAWING NO.	REV
B	404296	A

FILE NAME	SIZE	SCALE		SHEET
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dwg no 404296 sht 10 rev A

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REVISIONS

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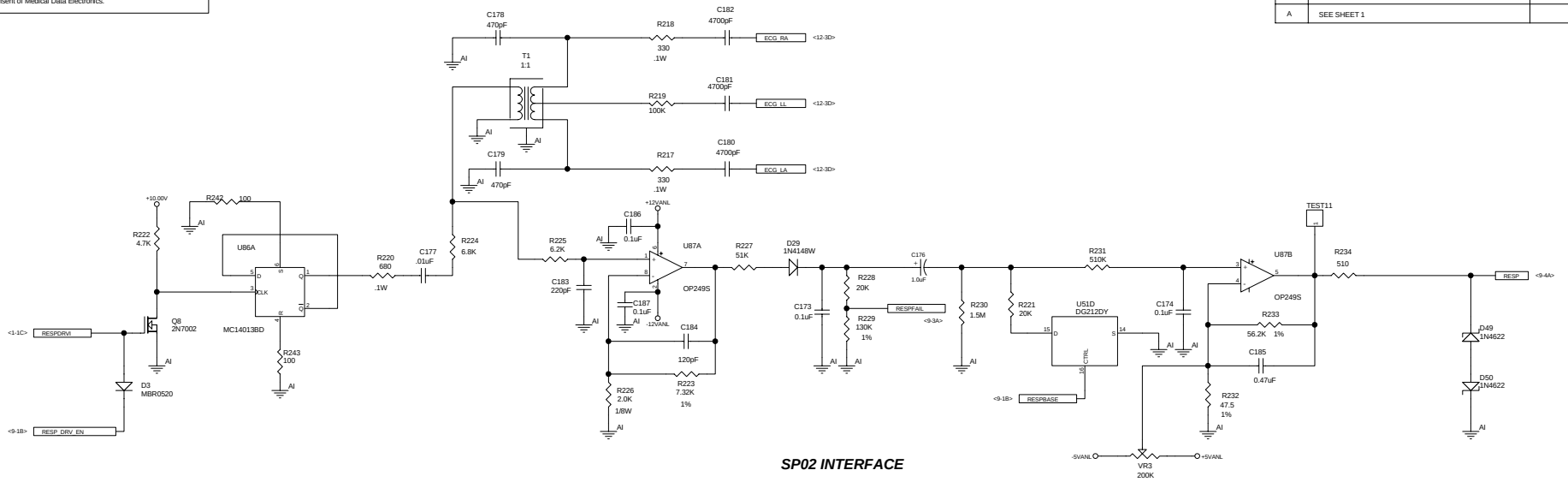

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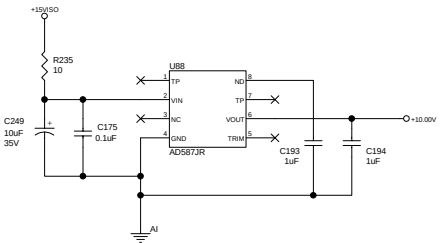

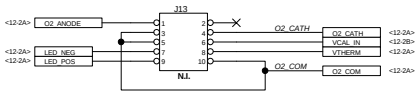

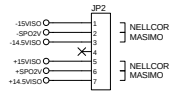

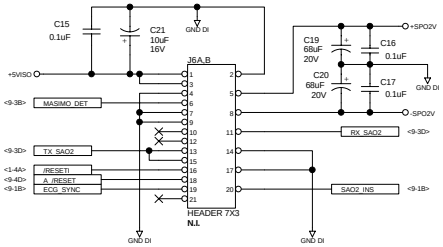

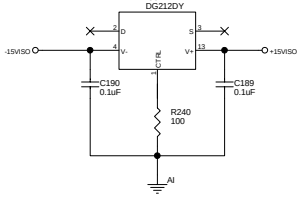

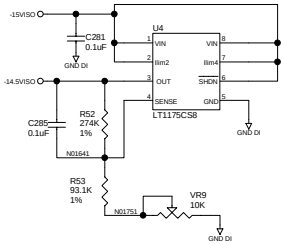

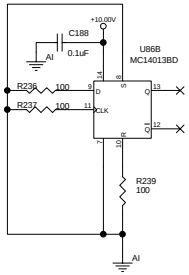

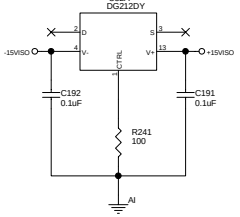

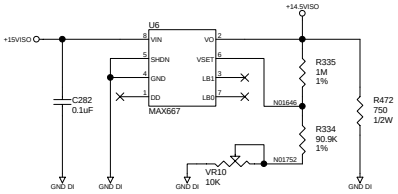

SIZE	DRAWING NO.	REV
B	404296	A

FILE NAME	SIZE	SCALE		
ECG2.SCH	C	NONE	PCB REV: A	SHEET 11 OF 14

DWG NO 404296 SHT 11 REV A

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REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	SEE SHEET 1		

ECG

J1 HEADER .2 CENTER
ECG_LAO, ECG_LLO, ECG_RAO, ECG_CO, ECG_RLO, ECG-SHLD

DS6 GAS TUBE — L1 BLM21B272S — ECG_RA <10-4C>
DS5 GAS TUBE — L2 BLM21B272S — ECG_LA <10-4D>
DS4 GAS TUBE — L3 BLM21B272S — ECG_LL <10-4C>
DS3 GAS TUBE — L4 BLM21B272S — ECG_C <10-4C>
DS2 GAS TUBE — L5 BLM21B272S — ECG_RL <10-4A>
DS1 GAS TUBE — L6 BLM21B272S — R21 4.7K 1/4W

R19 10 .5W
R20 100M 3/4W
D24 MLL4001, D25 MLL4001, R22 4.7K 1/4W
D26 MLL4001, D27 MLL4001
AI

ISOLATION BARRIER

BLOOD PRESSURE 2

TEMPERATURE 1

L33 BLM21B272S — T1_TIP — T1_TIP <7-4B>
L34 BLM21B272S — T1_RING — T1_RING <7-4B>
L35 B2M21B272S
D14 MLL4749A, D13 MLL4749A, D12 MLL4749A
AI

TEMPERATURE 2

L36 BLM21B272S — T2_TIP — T2_TIP <7-4B>
L37 BLM21B272S — T2_RING — T2_RING <7-4B>
L38 B2M21B272S
D17 MLL4749A, D16 MLL4749A, D15 MLL4749A
AI

L30 BLM21B272S

FLEX CONN J2

1	BP_GND
2	P3 -
3	BP_REF
4	P3 +
5	T1-RING
6	T1-TIP
7	T2-RING
8	T2-TIP
9	T-BASE
10	P2 -
11	BP_REF
12	P2 +
13	P1 -
14	BP_REF
15	P1 +
16	GND
17	R_CAL
18	LED+
19	LED-
20	VTHRMRET
21	DET_ANOD
22	DET_CATH
23	V_THERM
24	GND_ANA2

BLOOD PRESSURE 3

D9 MLL4749A — L31 BLM21B272S — P_3A <8-4C>
BP_REF — L29 BLM21B272S — +5VBPTREF
D10 MLL4749A — L32 BLM21B272S — P_3C <8-4C>
D11 MLL4749A

BLOOD PRESSURE 2

D7 MLL4749A — L27 BLM21B272S — P_2A <8-4C>
D8 MLL4749A — L28 BLM21B272S — P_2C <8-4C>

BLOOD PRESSURE 1

D5 MLL4749A — L25 BLM21B272S — P_1A <8-4D>
D6 MLL4749A — L26 BLM21B272S — P_1C <8-4D>

SAO2

L8 BLM21B272S — VCAL_IN <11-2C>
L7 BLM21B272S
L9 BLM21B272S — LED_POS <11-3C>
L10 BLM21B272S
L11 BLM21B272S — LED_NEG <11-3C>
L12 BLM21B272S — VTHERM <11-2C>
L13 BLM21B272S — O2_COM <11-2C>
L14 BLM21B272S — O2_CATH — O2_CATH <11-2C>
L15 BLM21B272S — O2_ANODE — O2_ANODE <11-3C>

DWG NO 404296 | SHT 12 | REV A

SIZE	DRAWING NO.	REV
B	404296	A

FILE NAME	SIZE	SCALE		
CONN.SCH	C	NONE	PCB REV: A	SHEET 12 OF 14

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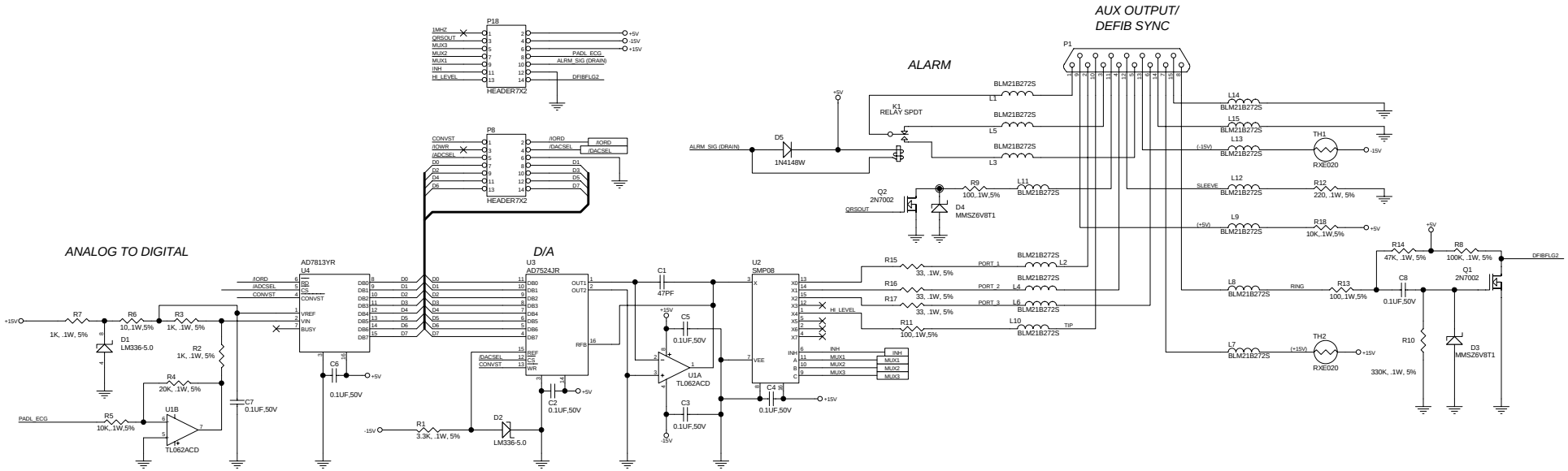
REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	RELEASE PER ECO# 3035A	12-22-98	
B	PER ECO# 3055	01-29-99	
C	PER ECO# 3060	02-04-99	
D	PER ECO# 3109	05-14-99	



LAST USED

C8, D5, K1,
L15, P18, Q2,
R18, TH2, U4,

UNUSED COMPONENTS

P2 - 7, P9 - 17,

UNUSED LABELS

PARTS FLOWN

SHEET NO.	FILE NAME	UNLESS OTHERWISE SPECIFIED: ALL RESISTOR VALUES ARE IN OHMS, 1/16W, 5% ALL CAPACITOR VALUES ARE IN MICROFARADS, 20%	APPROVALS	DATE	Medical Data Electronics
			DRAWN MIKE H.	12-10-98	TITLE: PRISM SE, OPT ACCESSORIES SCHEMATIC
			CHECKED JAY D.	12-31-98	
		ARTWORK/FAB 403510	APPROVED ROY CARR	01-04-99	SIZE B · DRAWING NO. 403511 · REV D
		ASSY/BOM 403511	OTHER		
		REFERENCE DRAWINGS	FILE NAME 403511D.SCH	SIZE C	SCALE NONE · PCB REV: C · SHEET 1 OF 2

DWG NO 403511 SH# 1 REV D

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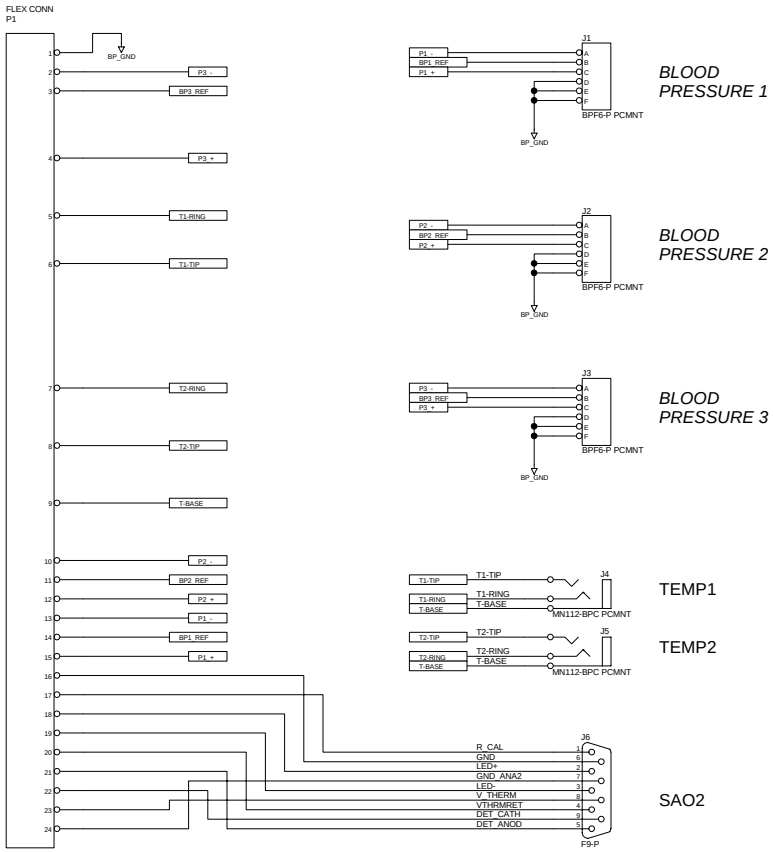
REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	RELEASE PER ECO# 3030	M.H. 12-23-98	



LAST USED

J6 P1

UNUSED LABELS

UNUSED PARTS

PARTS FLOWN

		UNLESS OTHERWISE SPECIFIED:	APPROVALS	DATE	Medical Data Electronics
		ALL RESISTOR VALUES ARE IN OHMS, 1/16W, 5%	DRAWN MIKE H.	09-23-98	TITLE: PRISM SE FLEX CIRCUIT SCHEMATIC
		ALL CAPACITOR VALUES ARE IN MICROFARADS, 20%	CHECKED		
		ARTWORK/FAB 403544	APPROVED		SIZE B / DRAWING NO. 403545 / REV A
		ASSY/BOM 403545	OTHER		
SHEET NO.	FILE NAME	REFERENCE DRAWINGS	FILE NAME 403545A.SCH	SIZE C	SCALE NONE / PCB REV: A / SHEET 1 OF 1

DWG NO 403545 SHT 1 REV A

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